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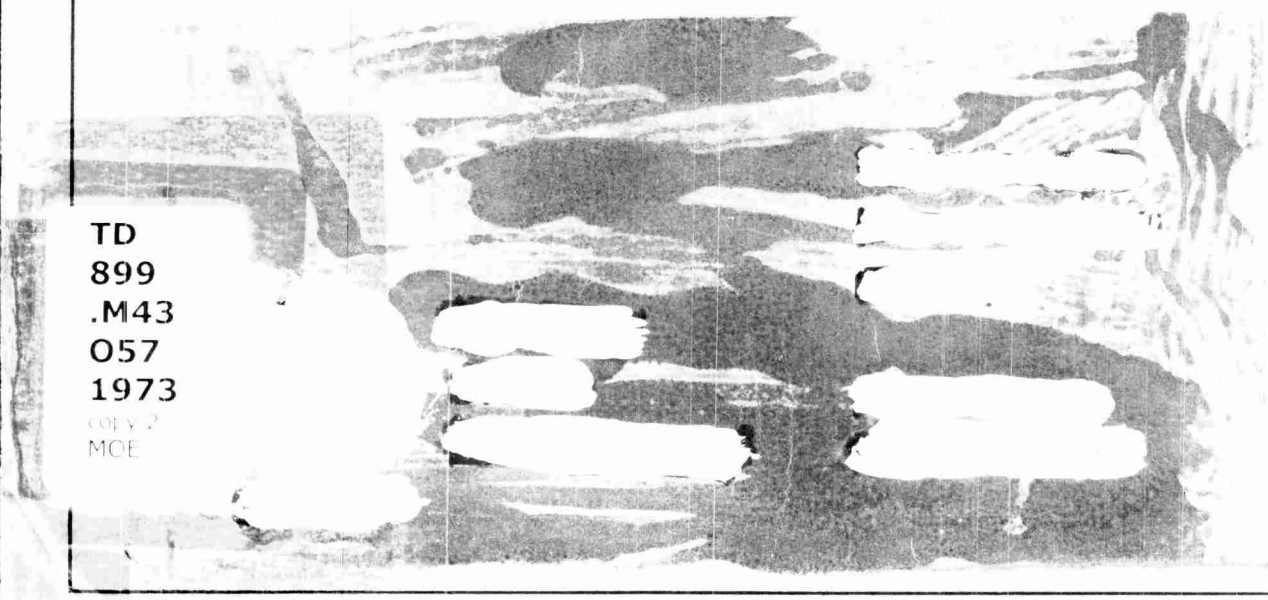
INTERIM REPORT ON LEAD IN THE ENVIRONMENT IN THE VICINITY OF SECONDARY LEAD SMELTERS IN METROPOLITAN TORONTO



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PREFACE

PERSPECTIVE ON THE INTERIM REPORT ON LEAD IN THE ENVIRONMENT IN THE VICINITY OF SECONDARY LEAD SMELTERS IN TORONTO

In preparation of this report, we have drawn on the expertise gained in the area of lead pollution by Air Management Branch personnel and the experience of others including the City of El Paso, the State of Texas and the Canadian Environmental Protection Service.

The problems of environmental contamination by trace quantities of toxic materials are extremely complex and difficult to solve. Much more work is needed to define the relative importance of each contributory source of lead contamination and the effect on the environment and on residents in the vicinity of lead plants. A program to this end will continue in 1974.

The findings and conclusions expressed in this report represent the current opinion of the Air Management Branch and are based on the data available to them. Nevertheless, in view of the paucity of information available in the world, these views may change as new data are revealed.

The report should be viewed as a whole and care should be taken to avoid the taking of data out of context as this may readily lead to erroneous conclusions.

At this time (December 19, 1973), medical evidence regarding the health hazard from lead in the vicinity of the plants is not available in a form suitable for inclusion in the report. It is intended that this be issued as an addendum at a later date.

C.J. Macfarlane
Director
Air Management Branch

INTERIM REPORT ON

LEAD IN THE ENVIRONMENT IN THE VICINITY

OF SECONDARY LEAD SMELTERS IN METROPOLITAN TORONTO

AIR MANAGEMENT BRANCH

MINISTRY OF THE ENVIRONMENT
ONTARIO

COMPILED BY THE WORKING COMMITTEE
ON LEAD POLLUTION:

DR. G.J. STOPPS
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REPORT CO-ORDINATOR:

DR. R.M.R. HIGGIN

DATA ON AUTOMOTIVE LEAD EMISSIONS
FROM DR. E.F. MULLER, SPECIAL STUDIES

ENTERED OCT 04 2001

CONTENTS

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LEAD IN THE ENVIRONMENT IN THE VICINITY OF SECONDARY LEAD SMELTERS IN METROPOLITAN TORONTO

Summary Abstract

Preliminary studies have confirmed that lead levels in air, soil, and vegetation in the vicinity of the Canada Metal Company and Rotocast Limited and Toronto Refiners & Smelters Limited are above normal expected ranges.

The degree of contamination decreases exponentially with distance from the plants and is largely confined to a radius of 1/4 mile with the highest levels close-in.

The quantity of settleable lead particles required to produce the present rate of contamination of soil and high lead in dustfall readings has been found to be very small. In order to meet the above-mentioned desirable ranges a very high degree of control over fugitive dust emissions will be required.

The evidence available at this time tends to discount re-entrainment as a major cause of high lead deposition rates or ambient air lead levels except under certain meteorological conditions favourable to raising previously deposited dusts.

Human body lead burdens as indicated by blood lead levels show a moderately significant correlation ($0.05 < p < 0.1$) with distance from

Continued..

the Canada Metal Plant. The data are too limited at the Toronto Refiners and Smelters Plant and merely point to high levels close-in. When medical data is analyzed, it will be issued an addendum to the report.

On-going studies aimed at identifying the sources of fugitive lead emissions and indicating the success of the control programs for process emissions will continue during 1974. These studies will include sampling of soil vegetation and snow, increased monitoring, particle sizing, stack sampling and remote sensing.

2. Background History (detailed description in Section 5.1)

The Canada Metal Company and Toronto Refiners and Smelters Plant operate secondary lead smelters located in the City of Toronto in areas consisting of mixed industrial, commercial, and older residential properties. Canada Metal Company, in addition to producing lead and lead alloys, produces lead oxides by the Barton Oxide Process. A wide range of alloys of copper zinc and lead are also produced by Roto Cast Limited, an affiliate of Canada Metal at the Eastern Avenue plant.

Canada Metal has been in operation for 45 years and Toronto Refiners and Smelters for 25 years.

During the early years of operation, emissions to the atmosphere at both plants were largely uncontrolled. When some equipment to collect particulate matter emissions was installed, this was to prevent loss of valuable lead-bearing material rather than contamination of the neighbourhood.

Regulations governing acceptable levels of lead in the air were not made until 1968. Until this time, the attentions of the Industrial Hygiene Branch of the Province and, later, the Air Pollution Control section of the Metro Public Works Department were directed at improvement of in-plant conditions and reduction of emissions of black smoke.

In 1968, Air Pollution Control came under the jurisdiction of the Province and a regulation was made which set standards for permissible concentrations of 15 airborne contaminants, including lead for which the standard set was 20 $\mu g/m^3$ for 30 minutes and a criterion for desirable air quality of 15 $\mu g/m^3$ for 24 hours.

Toronto Refiners and Smelters was identified as a probable source of lead contamination subsequent to a survey in late 1971. In July, 1972 the scrap battery crushing operation was identified as a major source of contamination and a Stop Order was issued against the operation. The Company, under pressure from the Air Management Branch, undertook a program of emission control which signficantly reduced emissions from identified sources.

Canada Metals and Rotocast Limited were identified as sources of lead contamination in mid-1972 and Canada Metal was issued with a Control Order requiring control of identified sources of lead emissions by early 1974. This control program proceeded well until late 1973 when difficulties were encountered, including difficulty with obtaining a building permit for installation of control equipment. The Company have received three Violation Notices for non-compliance with the Order.

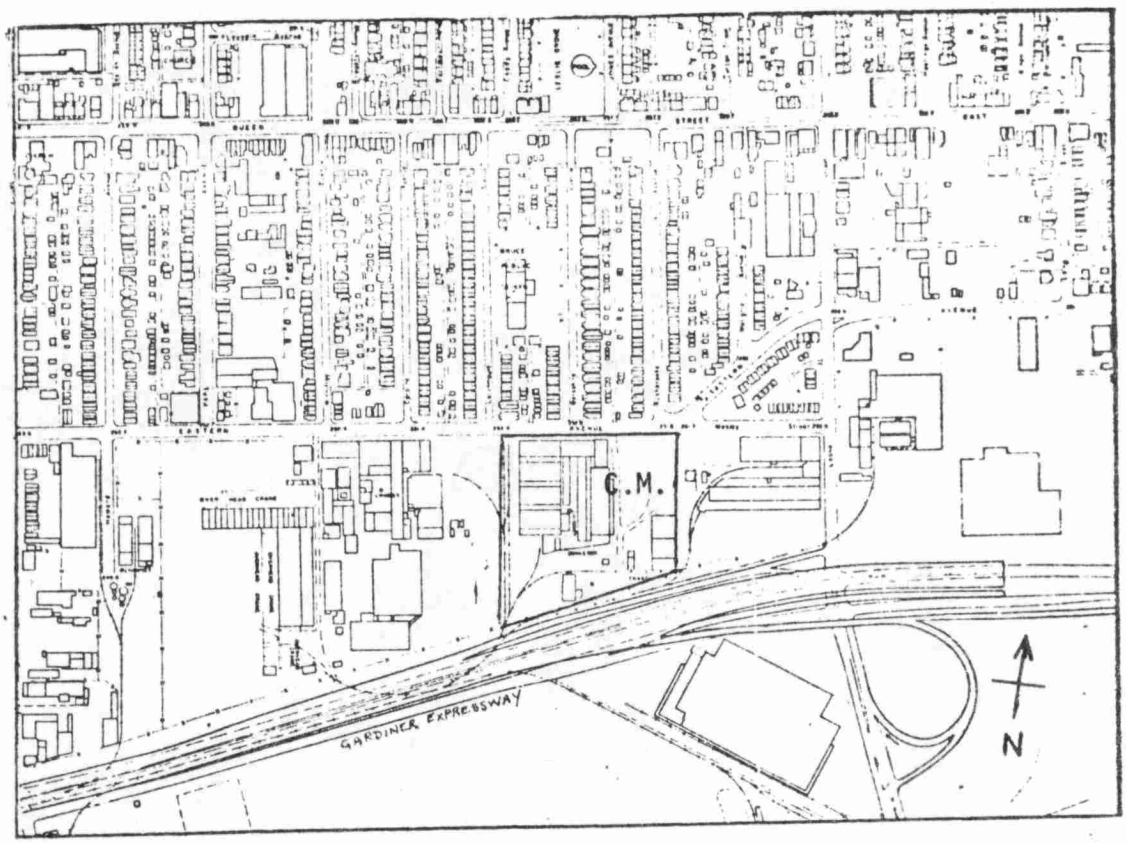
On October 26, 1973, the Director was advised of high blood lead levels in the immediate area of Canada Metal and issued a Stop Order against Canada Metal based on a health hazard. A Supreme Court appeal by the Company was upheld due to lack of evidence linking the high levels with present plant operations.

3. Location of Smelters

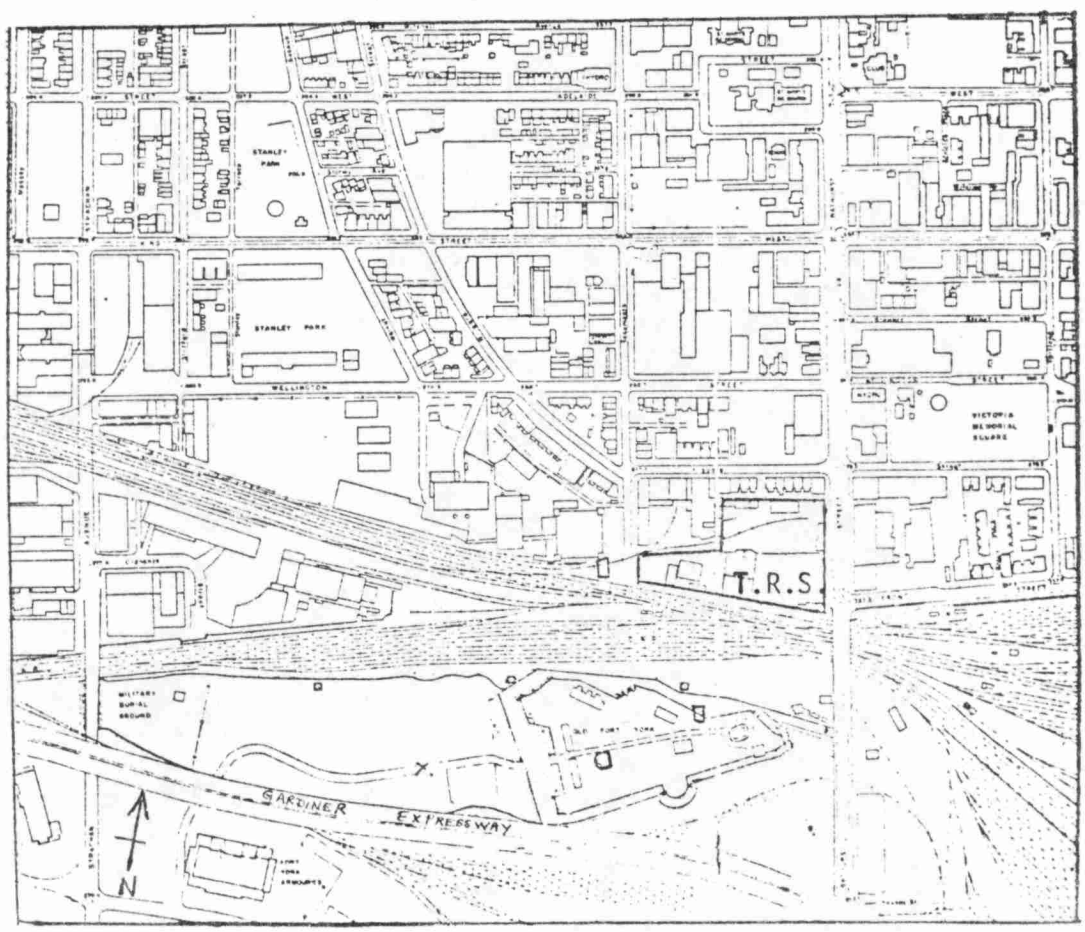
Problems due to emissions are greatly magnified by poor land usage around both Canada Metal & Toronto Refiners & Smelters. At Toronto Refiners the backyards of the houses abut the plant property line whilst at Canada Metals houses are situated within 100' of the property.

Both plants are situated adjacent to major arterial streets and close to the Gardiner Expressway so that there may be some contribution from traffic generated lead-containing particulates. This is discussed further in the sections on Air Quality & Phytotoxicology.

FIG. 1. LOCATION MAPS OF CANADA METAL & TORONTO REFINERS & SMELTERS



CANADA METAL COMPANY & ROTOCAST LIMITED



TORONTO REFINERS & SMELTERS LTD.

SECTION 4

ANALYSIS & SUMMARY
CANADA METAL COMPANY &
ROTOCAST LTD.

721 Eastern Avenue

LIST OF FIGURES & TABLES SECTION 4

4. Analysis & Summary - Canada Metal Company & Rotocast Limited

4.1. Process & Emissions

Identified emissions of contaminants from the plants are listed in Sec. 5.1, page 16.

Controlled lead emissions of between 5.8 lb and 3.1 lb/hr have been identified from Canada Metal with other unidentified emissions of particulates containing lead from low level sources and a maximum emission rate of 11.2 lb/hr from Rotocast Limited for short periods.

Particulate emissions pass through baghouses which can be expected to remove better than 98% by weight of the larger particles. Residual fine particles and sulphur oxides are dispersed from a high stack to ensure that air quality standards are met.

4.2, 4.3 Levels of Lead in Air & Dustfall (For details see Air Quality report)

Urban Background Levels

Urban background levels of lead in air, dustfall and soil are due mainly to automotive exhaust emissions with some contribution other sources of inadvertent lead emissions such as sewage sludge incinerators, municipal refuse incinerators and thermal power stations.

Data obtained by the Air Management Branch (Figure 2) indicate a median provincial value for suspended lead in air of 0.9 ug/m^3 with levels in the range 1.1-2.4 ug/m^3 occurring in Metro Toronto. Lead in dustfall data taken in early 1973 indicate normal values in the range 0.03 - 0.08 tons/$mile^2$/30 days for Metropolitan Toronto.

Background Levels at Canada Metals

The Canada Metal Company is located 500 feet north of the Gardiner Expressway and faces on to Eastern Avenue. In addition to

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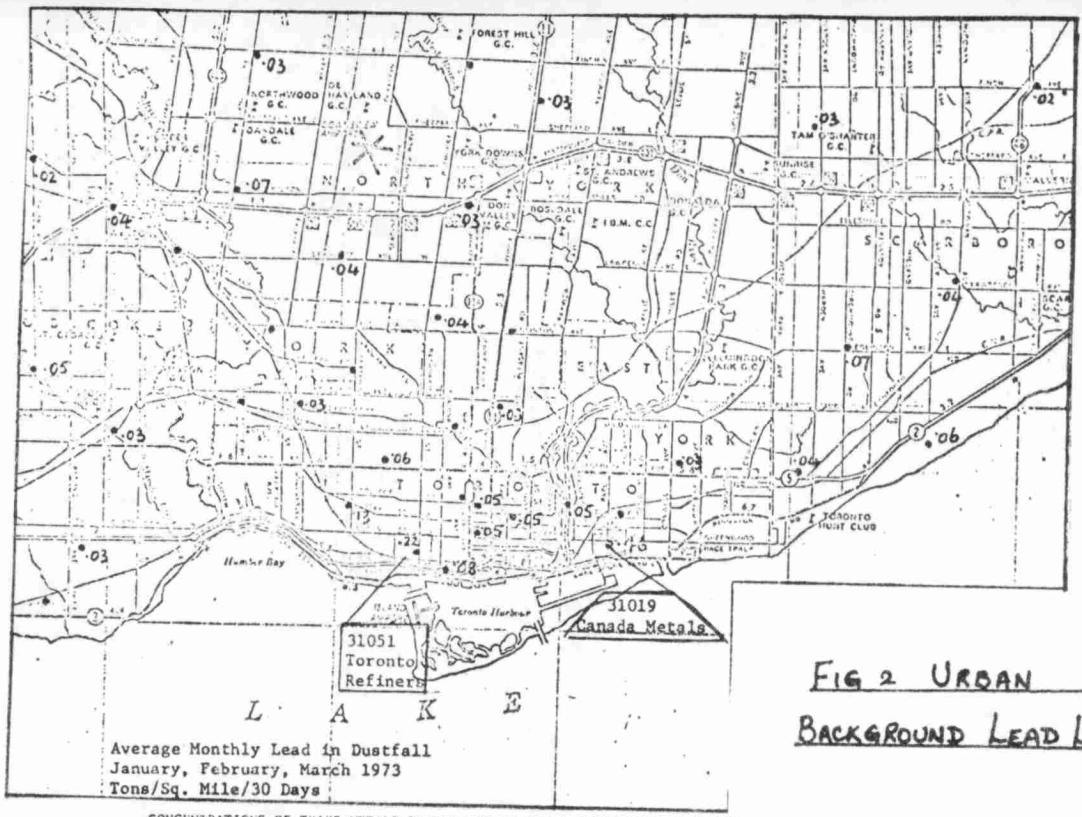


FIG 2 URBAN BACKGROUND LEAD LEVELS

CONCENTRATIONS OF TRACE METALS IN THE AIR OF ONTARIO COMMUNITIES (1971)

Station	No. of Samples	GEOMETRIC MEAN (MICROGRAMS PER CUBIC METRE)								
		Fe	Mn	Cr	Ni	Zn	Cu	V	Pb	Cd
1. Belleville P.O.	17 to 22	1.2	.04	.014	.026	.1	.09	.02	1.0	.005
2. Bramalea - Fire Hall	11 to 17	1.8	.05	.013	.014	.1	.08	.01	.7	.017
3. Brampton - Old Court House	14 to 24	1.4	.06	.012	.015	.1	.17	.02	1.0	.009
4. Brantford - P.O.	15 to 22	1.2	.07	.008	.023	.1	.05	.02	.8	.004
5. Brockville - Gen.Hosp.	14 to 20	.7	.03	.009	.021	.1	.09	.03	.5	.005
6. Chatham - P.O.	18 to 23	2.0	.06	.012	.070	.1	.07	.04	.6	.002
7. Cornwall - Mem. Park	33 to 49	1.4	.03	.009	.030	.1	.12	.05	.8	.010
Hamilton										
8.(a) Beach - North Park	29 to 38	6.1	.32	.031	.037	.7	.14	.03	1.7	.010
9.(b) North - Barton-Wentworth	58 to 67	6.5	.32	.031	.035	.4	.20	.06	1.7	.009
10.(c) South - Hughson-Main	19 to 24	3.6	.17	.017	.037	.2	.08	.04	1.2	.006
11. Kingston - City Hall	13 to 17	1.1	.03	.015	.025	0	.05	.02	.8	.005
12. London - King-Rectory	14 to 21	1.5	.07	.012	.035	0	.15	.02	.8	.008
13. Malton - Airport	11 to 21	.9	.05	.011	.014	.1	.10	.01	.5	.004
14. Mississauga - Library	13 to 23	2.7	.08	.014	.019	.1	.06	.02	1.3	.008
15. North Bay - Walker's Store	11	.7	.02	.010	.005	0	.05	.02	.5	.004
16. Oshawa - Library	13 to 15	1.2	.08	.017	.030	.2	.07	.01	.9	.007
17. Ottawa - Kenson Bldg.	12 to 19	1.1	.06	.015	.052	0	.07	.13	1.2	.005
18. Peterborough - Fire Hall	11 to 21	1.2	.06	.007	.008	.1	.10	.02	.8	.015
19. Pickering - Fire Hall	14 to 24	.9	.03	.007	.009	.1	.10	.01	1.0	.004
20. St. Catharines - 71 King Street	9 to 16	2.1	.18	.021	.026	.1	.10	.03	1.0	.003
21. Sarnia - Victoria St.	60 to 66	1.8	.04	.011	.018	.1	.17	.01	.9	.007
22. Sault Ste. Marie - Prov. of Ont. Bldg.	22 to 24	1.6	.04	.011	.004	.1	.05	.01	.6	.003
23. Simcoe - Hort. Stn.	15 to 20	1.3	.06	.009	.018	.1	.07	.01	.4	.004
24. Sudbury - Ash St.	33 to 35	3.7	.02	.010	.371	0	.50	.01	.5	.008
Toronto										
25.(a) City - 67 College	58 to 69	2.3	.07	.012	.021	.1	.09	.06	1.6	.010
26.(b) S.Etobicoke - Evans-Arnold	32 to 42	2.5	.10	.016	.034	.3	.19	.04	2.4	.012
27.(c) North York- Science Centre	19 to 29	.9	.05	.006	.025	.2	.06	.02	1.1	.006
28.(d) Scarborough - Lawrence-Kennedy	24 to 30	1.3	.04	.013	.020	.2	.06	.02	1.5	.014
29. Thunder Bay (N) - 14 Algoma St.	22 to 24	1.9	.04	.004	.004	.1	.08	.01	.3	.002
30. Thunder Bay (S)-Gen.Hosp.	10 to 22	3.5	.05	.006	.002	0	.12	.01	.6	.003
31. Waterloo - P.U. Substation	12 to 17	1.5	.05	.013	.024	.2	.13	.01	1.1	.004
32. Windsor (E) 471 University Ave.	33 to 41	3.8	.13	.026	.048	.3	.10	.05	1.3	.005
33. Windsor (W) - Morton Dock	10	5.0	.15	.022	.021	.1	.10	.01	.9	.014
MEDIAN VALUES		1.5	.06	.012	.020	.1	.03	.02	.9	.006

the normal urban background levels above one would expect that a further contribution from traffic generated lead particles would be present together with contributions from the Commissioners Street and Asbridges Bay incinerators.

Reported data on the variation of suspended lead levels with distance from highways (figure 3) indicate a large gradation with distance and traffic volume, with values reaching urban background levels in 500-1000' from the highway. Based on traffic volumes an Eastern Avenue (9,800 v.p.h.) and The Eastern end of the Gardiner Expressway (34,000 v.p.h.) it is reasonable to assume that an increase in background levels will occur close to Eastern Avenue due to traffic and a further increase will be present due to the proximity of the Gardiner Expressway.

The reported data would indicate a background value of about 2$\mu g/m^3$ from the Expressway and about the same from Eastern Avenue at Station No. 31058. These levels would not reinforce due to wind direction.

At Station 31045 one would expect a negligible contribution

Table I

Traffic Volume at Selected Locations of Metropolitan Toronto

Location	Vehicles Per Day
On Gardiner Ewy. at Spadina Avenue	93,000
On Bathurst St. between Queen St. and Lakeshore Rd.	14,700
On Gardiner Ewy. at Leslie St.	34,000
On Eastern Ave. at Coxwell St.	9,800

Source: Mr. I. Rohac - Automotive Section.

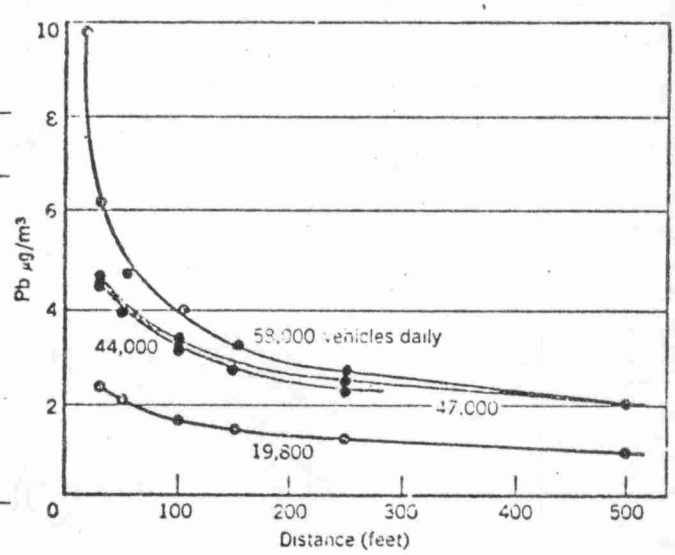


Figure 3 Air-lead values as a function of traffic volume and distance from the highway

4.2 Ambient Air Suspended Lead Levels

From the above discussion of background levels it can be seen that values of greater than 2.0 - 2.5 ug/m^3 are indicative of the presence of a source of lead emissions. The objective for suspended lead in air is 15 ug/m^3 for 24 hours at present and the proposed standard is 5 ug/m^3 for 24 hours.

Readings from a hi-volume sampler located 150' East of the plant property have exceeded the present objective on 14 occasions and the proposed standard on 20 occasions between April 15th and October 30, 1973 and there is a good correlation between lead concentration and the time the wind was blowing from the plant.

Readings from a hi-volume sampler located 600' North of the plant property have not exceeded the existing or proposed objective since the station was re-started in October 1973.

There is no correlation with wind speed at either location which tends to indicate that re-entrainment is not a major factor contributing to the measured levels.

4.3 Lead Dustfall and Lead Deposition Rate

Measurements of lead in dustfall indicate an exponential decay with distance from the Canada Metal Property, Fig (4). Calculations on particle fall-out patterns indicate that the observed pattern is consistent with particles in the size range 5-20μ emitted at moderate heights 30-60' although larger particles emitted from heights of above 150' could produce the same effect.

The percentage of lead in dustfall also shows a marked exponential decay with distance from the plant.

FIG. 4

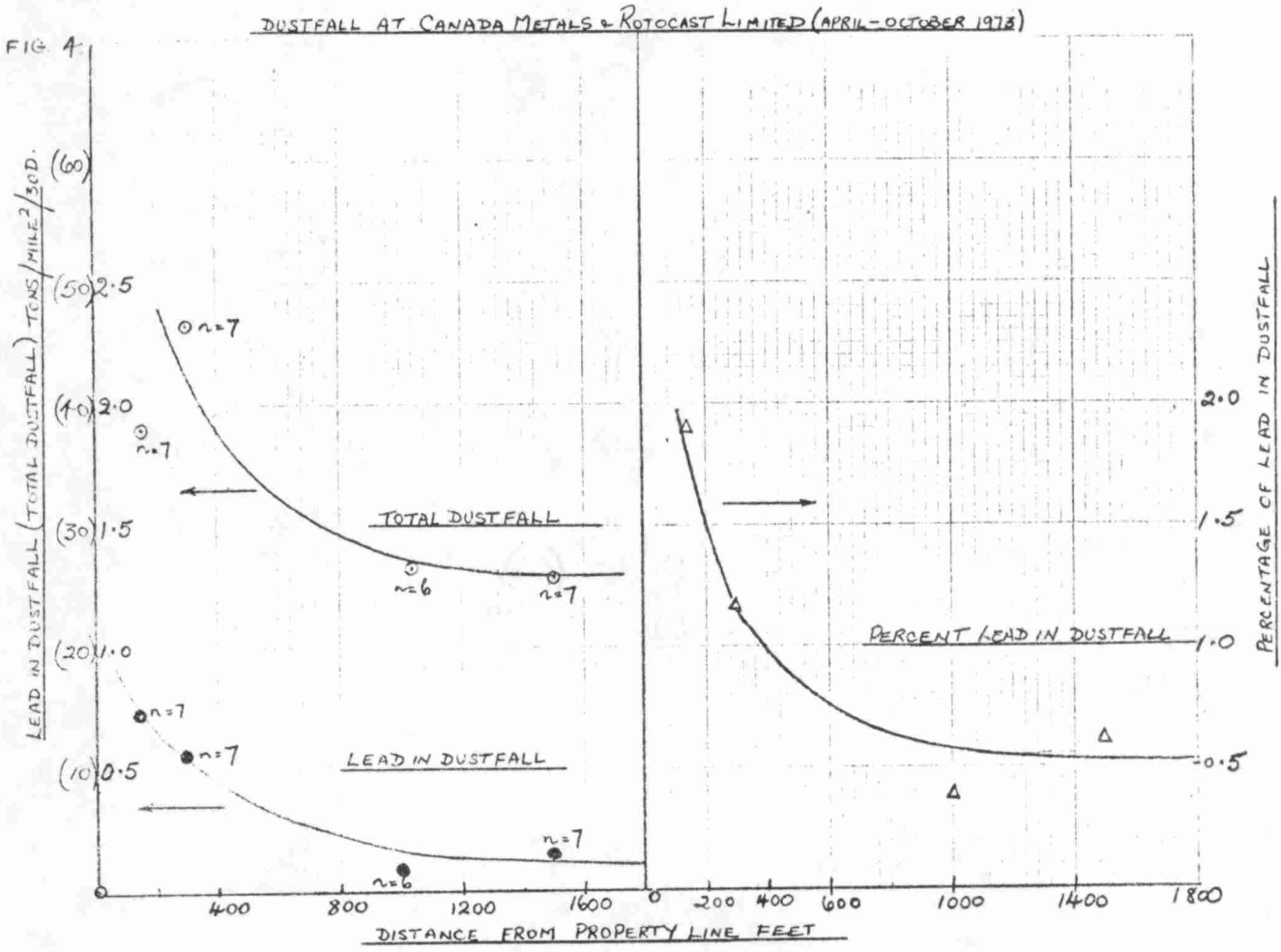


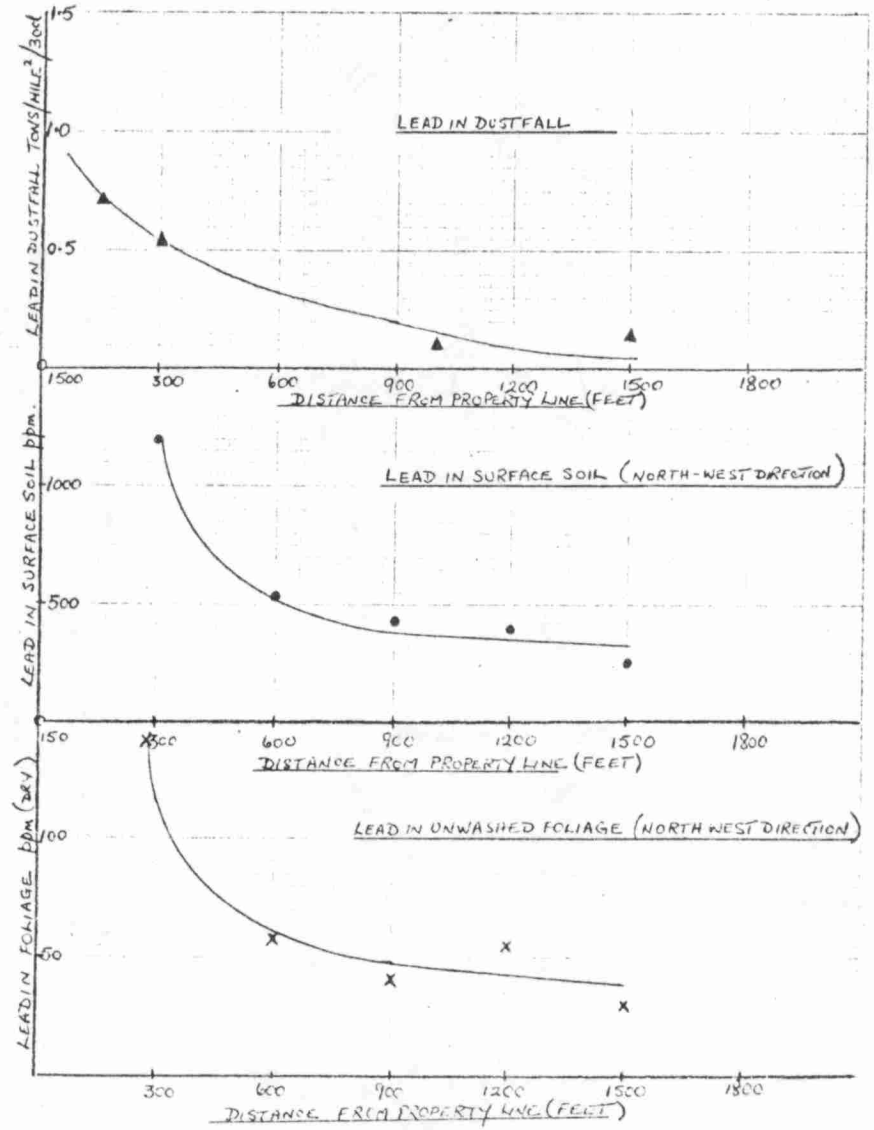
Table 2.

VARIATION OF LEAD IN DUST-FALL WITH DISTANCE
AT CANADA METALS & ROTOCAST LTD.

Distance Feet	Lead in Dustfall Tons/mile^2/30d	Standard Deviation	Distance meters	Lead in Dust grams/m^2/30d	Standard Deviation
150	0.72	0.22	46	0.25	0.08
300	0.55	0.09	92	0.19	0.03
1000	0.10	0.026	305	0.035	0.009
1500	0.15	0.03	460	0.053	0.01

Data are based on 7 months monitoring

FIG. 5 LEAD IN DUSTFALL, SOIL & VEGETATION AT CANADA METAL



4.4 Particle Size Analysis

No Air Management Branch data are available concerning the particle size range of lead in the air at sampling locations. Andersen Heads have recently been installed on sampler at Canada Metals and data will shortly become available.

Data obtained by the University of Toronto at a sampler located 300' to the North of the plant indicate that a significant portion was in the range >7u and a further significant portion in the range <1-1u.

This tends to support the theory that particles at this distance due to fume are coming from medium height sources such as roof vents and low level sources with some contribution from low level sources of larger particulates. A part of the fraction <1.1u may be due to automotive lead emissions.

4.5 Lead Contamination of Soil & Vegetation (Detailed Report Section 5.2)

Lead contamination of surface soil & vegetation decreases with distance from the Canada Metal plant. Significant correlations are found for surface soil in the N, NW, & South directions and for vegetation in the N, NW, SW & Southerly directions.

Background levels of lead in soil and vegetation are shown in Table 3 together with levels close to a major highway. It can be seen that levels are elevated close to the highway but comparison with urban levels shows that the range is about the same. The conclusion is that levels in excess of 400 ppm of lead in soil and 100 ppm in not washed vegetation is indicative of a source of lead contamination in the area.

TABLE 3. LEAD LEVELS FOUND IN ONTARIO SURVEYS

SOME AVERAGE LEAD LEVELS	SOIL[1]	VEGETATION[1]		AIR[2]	
	(ppm, dry wt.)	(ppm, dry wt.)		ug/m^3/24 hr.	tons/mi^2/30 days
	0 - 2"	not washed	washed	suspended particulate	dustfall
Rural Area	<100	15	10	<0.5	0.01
Urban Area	2-300	70	35	2-3	0.05-0.1
Adjacent to Highway and Major Street Location	3-400	100	50	4-5	0.1-0.2
Considered Excessive	600	150	75	5	0.3

LEVELS OF LEAD IN SOIL COLLECTED IN THE VICINITY OF HIGHWAY 401, JULY 1972

Distance from pavement (feet)	Levels of Lead (ppm, dry weight)					
	South of Highway			North of Highway		
	0-1"	1-4"	8-10"	0-1"	1-4"	8-10"
10	300	88	30	195	83	38
25	183	65	18	103	35	23
50	100	43	15	88	40	18
100	88	33	18	75	35	25
200	58	30	18	55	30	20
500	73	30	18	40	28	18
800	40	23	20	30	20	20

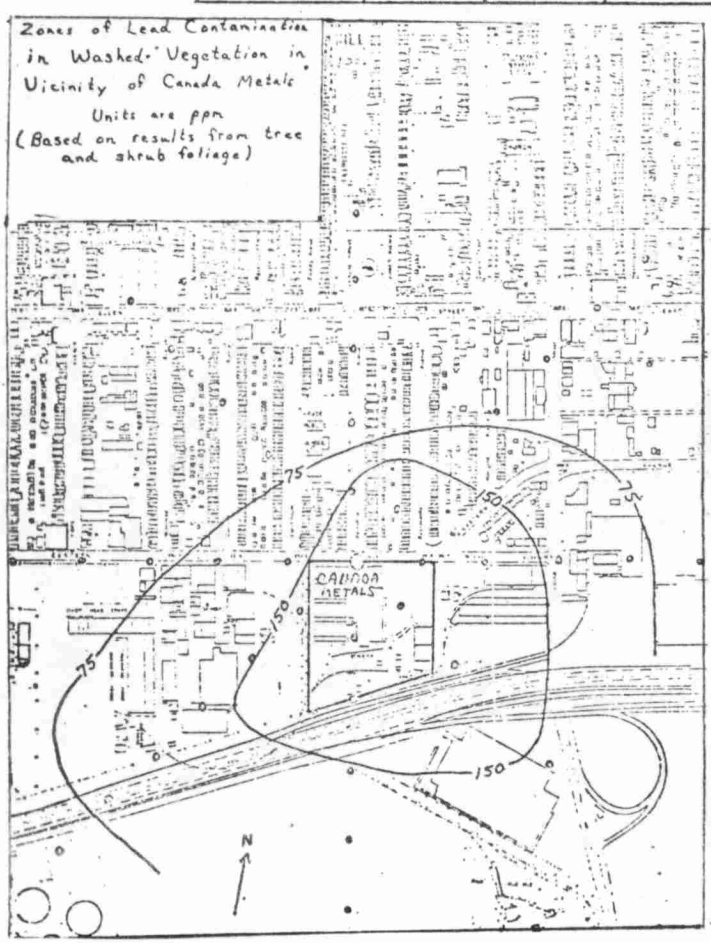
-FIG. 6

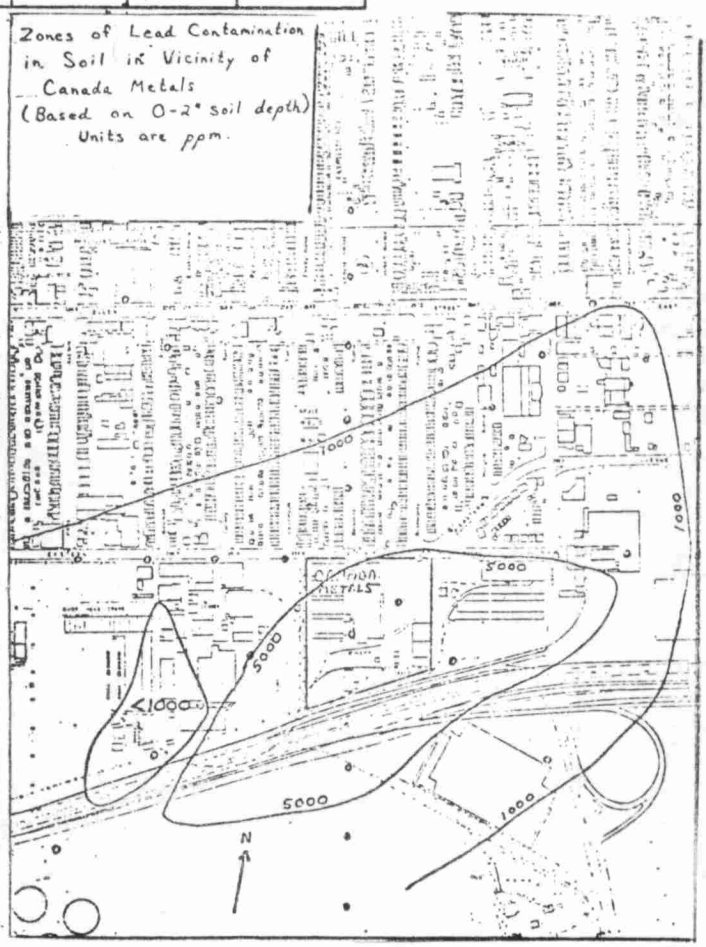
LEAD CONTENT OF SOIL COLLECTED IN VICINITY OF CANADA METALS
IN PARTS PER MILLION, DRY WEIGHT
(NOVEMBER 2,5, AND 6/73)

Distance from Source	Direction															
	E		NE		N		NW		W		SW		S		SE	
	0-2"	2-4"	0-2"	2-4"	0-2"	2-4"	0-2"	2-4"	0-2"	2-4"	0-2"	2-4"	0-2"	2-4"	0-2"	2-4"
300'	5580	6200	1350	1360	1100	863	1210	1930	1920	1710	-	-	-	-	8583	-
600'	1630	1660	2440	1660	505	385	538	445	3600	3400	5700	3030	21200	555	13600	12400
900'	2300	2260	770	755	810	728	445	335	1140	1360	620	418	9700	7880	943	175
1200'	4650	795	1590	1350	133	135	415	318	1920	733	378	205	1990	1950	605	220
1500'	613	83	663	368	320	243	240	223	1090	1100	720	608	1180	495	378	145
1800'	-	-	318	195	-	-	-	-	-	-	2090	1310	-	-	-	-
Correlation Coefficient r*	-0.56	-0.93**	-0.57	-0.73	-0.82*	-0.77	-0.95**	-0.90*	-0.42	-0.50	-0.63	-0.58	-0.98**	-0.12	-0.74	-0.85

COMPARISON BETWEEN CANADA METAL AREA AND CONTROL AREA
WITH RESPECT TO LEAD CONTENT (PPM-DRY WEIGHT)
OF VEGETATION AND SOIL

Distance and Direction from Source (Simulated Source in Control)	Foliage				Forage (Grass)				Soil			
	Control Stations		Canada Metal Stations		Control Stations		Canada Metal Stations		Control Stations		Canada Metal Stations	
	NW	W	NW	W	NW	W	NW	W	0-2"	2-4"	0-2"	2-4"
1500 feet N	32	23	53	31	23	20	25	34	610	338	320	243
1200 feet N	44	33	39	25	42	20	-	-	403	413	133	135
900 feet N	77	56	59	50	34	21	413	102	240	180	810	728
600 feet N	50	50	75	62	42	31	58	15	743	568	505	385
300 feet N	-	-	94	90	36	23	159	112	583	610	1100	863
300 feet S	79	63	-	-	24	20	-	-	648	388	-	-
600 feet S	-	-	3530	2740	64	48	568	104	160	113	21200	555
700 feet S	Location of Gardiner Expressway											
900 feet S	67	75	105	123	-	-	305	219	183	153	9700	7880
1200 feet S	27	18	-	-	-	-	94	61	93	55	1990	1950
1500 feet S	18	18	123	108	23	23	62	41	80	43	1180	495





4.6 Conclusions Regarding Canada Metal

Investigations into various aspects of lead contamination in the vicinity of Canada Metal Company and Rotocast Limited are continuing at this time so that a clear-cut conclusion regarding the situation is not easy to make but, based on findings to date, a preliminary assessment is possible -

1. The evidence gathered to date is all circumstantial and each piece may be faulted in several ways but, when taken together, the indications are definitive that Canada Metal and Rotocast are a source of undesirable lead contamination at distances up to 1500' from the plant.

2. Even with the tightest degree of control possible at the plant, it may be impossible to ever attain levels of lead in air, soil and vegetation at distances under about 300' from the property line, which could be considered normal for urban areas remote from lead sources.

3. Evidence available at this time tends to discount re-entrainment of deposited lead as a major factor contributing to high suspended lead and lead in dustfall readings, except possibly under high winds and very dry conditions.

   a) This is a negative correlation of suspended lead readings with wind speed.

b) Readings of suspended lead are not significantly different following precipitation days when dust from ground surfaces will be dampened.

c) Lead in dustfall and suspended lead show little difference between winter and summertime.

d) Percentage of lead in dustfall decreases sharply with distance from the plant.

e) Calculations show that fall-out patterns are consistent with emissions from the plant property.

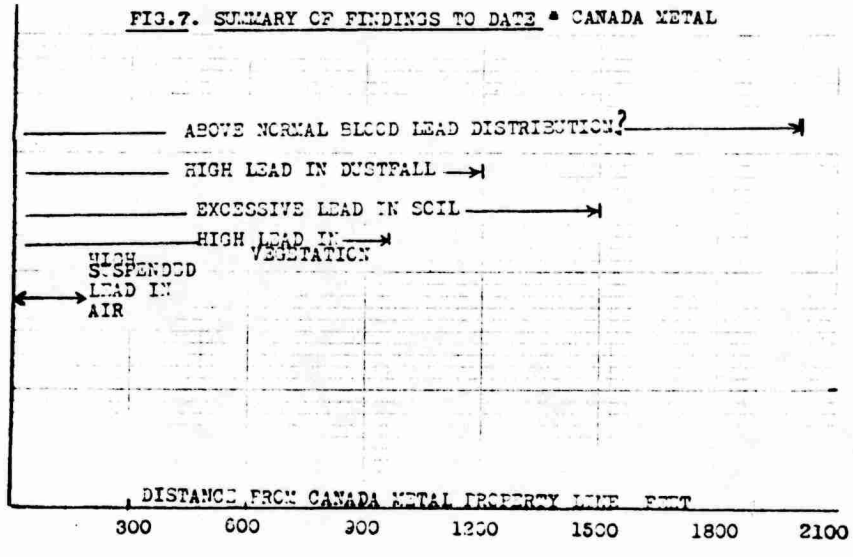
f) There is no difference between summertime and wintertime (snow cover conditions) readings of lead in dustfall close to the plant but total dustfall is a little lower.

4. Evidence available discounts background lead levels due to incinerators, etc. and lead levels due to vehicular traffic as contributing more than 2 - 3 ug/m^3 to levels found close to Canada Metals.

5. Elevated lead levels above normal urban values are due to both settleable lead particles and suspended lead particles.

6. Further studies are required to fill gaps in the data and to determine the contribution of the plant relative to other sources.

FIG.7. SUMMARY OF FINDINGS TO DATE * CANADA METAL



SECTION 5.1

ABATEMENT REPORT ON

CANADA METAL COMPANY LIMITED

& ROTOCAST LIMITED

721 Eastern Avenue
Toronto

By: C.E. DUNCAN
Asst. Chief of Abatement.

INDEX TO SECTION 5.1

ABATEMENT REPORT

THE CANADA METAL COMPANY, LIMITED
721 EASTERN AVENUE,
TORONTO, ONTARIO

This company manufactures lead and lead alloys for solder, and lead oxide for use in batteries and as paint pigments. The lead is derived from the melting of scrap batteries in a blast furnace. Various sized pots are used for melting lead and the production of various alloys.

The lead oxide is produced by melting lead in a pot furnace and subsequently converting this molten lead chemically into lead oxides in oxidizing furnaces.

The company erected this plant in 1925 and since 1928 has been continuously engaged in secondary lead smelting and refining operations. The first blast furnace and stack were erected in 1932, and a 3 section concrete baghouse added in 1936. The 152' radial brick stack was erected in 1941. The Oxide Plant was constructed with 7 separate filtration units in 1949 and a sanitary baghouse was added in 1949. Also, in 1949, the original blast furnace was demolished and a new unit constructed along with battery bins for storage of scrap battery plates.

In 1950, a 4 section addition was made to the existing blast furnace filtration unit.

In 1965, the company requested a permit from the City of Toronto to construct a reverberatory furnace and cyclone settling chamber, and duct the emissions to 2 sections of the existing baghouse. The company also went before the Committee of Adjustment to request an extension to the Roto-Cast Division. The Air Pollution Control Service advised the Committee that as the company had indicated that there would be no emissions to the outside atmosphere they had no objection to construction of the extension.

cont'd...

In May 1967, the company advised the Toronto Air Pollution group that they were having problems with bag failure on their baghouse and requested leniency against recorded violations due to extenuating circumstances. In an attempt to correct the problem, they replaced the silicon treated bags.

In July 1967, Roto-Cast Limited requested a permit to erect additional furnaces. They were advised that their application could not be recommended for approval as the emissions of zinc oxide and lead oxide were considered to be excessive. The company resubmitted their proposal in December 1967 and approval was granted for the installation, subject to annual review.

Canada Metals ducted two 40 ton kettles to the existing baghouse in 1967.

In March of 1968, the company was advised by letter that air pollution control was under provincial jurisdiction and the Air Pollution Control Service, Ontario Department of Health surveyed the plant. On completion of the survey, the Air Pollution Control Service wrote the Department of Health and expressed concern about the effect of lead emissions on children in the community and requested any information they may have on lead effects in the community. The Department of Health replied on April 10, 1968 and referred to its experience at Toronto Refiners and Smelters, where a girl had high lead levels because her father worked at the plant and carried the lead home in his clothes, and inferred that there should be no community problem.

Towards the end of 1969, a preliminary emission survey and report was carried out at this plant. There were some visible emissions and these together with the results of the survey were discussed with the company. The proposed action involved replacement of the existing exhaust dust collection system on the blast furnace to reduce emissions. At this time, nine out of eleven emission points on the oxide plant were controlled by baghouses.

cont'd....

On March 4, 1970, a letter was sent to the company requesting a firm proposal for the installation of a new bag-house for the blast furnace. Subsequently, the company indicated that their parent company in the States was developing a new process which would eliminate the blast furnace and that they wished to await the results of this study before making any commitments.

Following a request for air quality monitoring on September 26, 1971, a hi-vol sampler was set up on the nearby Bruce Public School.

As mercury is found in small quantities,with zinc copper and lead in ore bodies, there was a concern on the part of the Branch that there may be mercury emissions from this plant. Therefore, on October 31, 1971, a request was made to the laboratory for mercury monitoring in the area. However, no mercury was detected.

In September 1971, area residents requested a meeting with the company and the Air Management Branch, to discuss air pollution problems at the plant. As a result of this meeting, the company invited representatives from the community, the Air Management Branch and the press to tour the plant. The tour took place on September 13, 1971.

An additional emission survey report was completed on the plant in October, 1971.

On November 3, 1971, an abatement meeting was held with a company representative and a confirming letter, with the results of the meeting, stipulated that SO_2, PbO, and particulate matter from the blast furnace slagging operations were in violation. Lead from the oxide plant was in violation. The Roto-Cast emissions from the main stack were not considered to be in violation. Lead and other particulate matter from melting and alloying operations were in violation.

cont'd....

On November 19, 1971, the company wrote back indicating that they would review by January 31, 1972, the findings of violations and submit a program by March 31, 1972. An application for the slag tap control was included.

The laboratory reported negative results from the mercury sampling and the Phytotoxicology Section conducted a vegetation and soil survey in Metropolitan Toronto in July 1971.

On January 28, 1972, the controls for the blast furnace slagging operation were approved and Certificate of Approval was issued.

On February 3, 1972, the first group of Phytotoxicology results on vegetation and soil indicated excessive lead levels in the vicinity of Canada Metal.

An employee strike occurred and all operations, including Roto-Cast Limited (an independant operation within the plant), were shut down from March 14, 1972 to April 14, 1972, with the exception of the lead oxide plant.

Analyses of dustfall for the period February 1971 to February 1972 of 0.29 to 0.73 tons/sq. mile/30 days. This lead content is elevated by comparison with levels in areas remote from this type of operation.

On March 28, 1972, the company submitted a program for Branch approval. This submission was denied June 6, 1972, because of the indefinite nature of several parts of the proposal and the lack of completion dates in other instances.

cont'd....

The company noted in their submission that Roto-Cast Limited was not in violation of the Act and that therefore no corrective action would be undertaken at this time. Calculations performed by the Air Management Branch, based on the best available data, indicated that the emissions from Roto-Cast Limited alone were not in violation of the Act or regulations. Therefore, no formal commitment for a control program was required of Roto-Cast Limited. However, it was pointed out to Canada Metal that if Roto-Cast Limited did not control the emissions from their operations, the emissions from Canada Metal would have to be controlled to a greater degree in order to meet the 20 ug/m^3 standard from all sources on the property in the aggregate.

A second submission was received from Canada Metals on July 6, 1972 in which the following were to be controlled:

Oxide Plant

Lead melting pot	September, 1972
Oxidizing (Calcining) Furnaces	April 30, 1973
Other exhaust points and baghouses	December 31, 1973

Smelting, Refining & Fabrication

Blast furnace building (slag tap, skip hoist, lead well)	September 15, 1973
Lead melting (& refining) pots	November 15, 1973

This submission was also rejected on July 28, 1972 since conditions of "Company directorial approval" and "limitations to accepted industrial practices" were not acceptable to the Branch.

On August 4, 1972, the company president, met the Director to explain the conditional clauses of the submission (financial and technical difficulties experienced at their other plants). The Director advised the company that it was not possible to approve the submission with these conditions included.

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A soil sample on the company premises indicated a 36% lead content (about August 1, 1972). This finding has led to the inclusion of an item in the control order for improvement in housekeeping.

On August 14, 1972, the Director stated in a letter to the company that October 1, 1972 was the final date for an acceptable submission. On September 15, 1972, a Notice of Intent and Mini Report were served alleging that lead and lead compounds exceeded the regulations at the melting and alloying furnaces, oxide plant, and in the aggregate from other sources.

On September 11, 1972, the company stated a scrubber-precipitator test unit arrived, failed to perform, and was abandoned. These tests were carried out on the blast furnace exhaust.

On September 29, 1972, a third submission was received and a program was drafted for discussion. The branch expressed reservations about accepting it as it was anticipated that the regulation would be changed and the new standard for lead would be 10 ug/m^3 instead of 20 ug/m^3. The branch also expressed concern that cadmium and silver emissions were not included in the control program.

On January 16, 1973, it was resolved that until the regulation was changed the branch could only enforce the 20 ug/m^3 standard. It was also decided that if the company controlled their lead emissions, arsenic and cadmium emissions would likely be controlled at the same time. Therefore, it was agreed that the program should be approved as written.

cont'd.....

On January 31, 1973, the program was sent to the Legal Services Branch for their review. They returned the program, pointing out that the standard of 20 ug/m^3 for lead had not been specified. They further noted that the regulation specified a standard for lead only and not lead compounds. The Air Management Branch reviewed the comments and decided to retain the original wording of the program, as it was more general and would not be affected by a change in the regulations.

This program was finally approved by all concerned on March 23, 1973, and served on March 28, 1973.

The program approval completion dates were as follows: (lead and particulate).

Oxide Plant

Lead melting pot.....October 6, 1973

Oxidizing furnaces..... May 30, 1973

Other exhaust points and production baghouses.....December 31, 1973

Smelting, Refining & Fabrication Division

Blast furnace building.....September 15, 1973

Lead melting pots..... November 15, 1973

The Plant in aggregate..... December 31, 1973

During this interval, September 29, 1972 - March 28,1973, the following relevant activities took place:

(1) Revisions were made to the draft section 83 report to include silver, arsenic and cadmium. Of these, only silver and cadmium were assessed to be a problem, however, no changes in the program requirements were considered necessary since correction of the lead emissions would automatically correct the silver and cadmium.

(2) Since the company disputed some of our calculated emission figures, they engaged a consultant to carry out stack testing of the disputed sources. Some of our calculated emission figures were modified as a result of their tests. The test results were submitted on February 22, 1973.

cont'd....

(3) Samples from the Hi-vol located on Bruce Public School were analysed and the results indicated lead levels below 8 micrograms/m^3/24 hr. The present standard is 15 ug/m^3 on a 24 hour average. Zinc and Cadmium were also at acceptable levels.

(4) The slag tap at the blast furnace was connected to the blast furnace baghouse and 150' stack in October, 1972.

On December 18, 1972, the Phytoxicology Section's results came in on samples collected on September 20, 22, 1972. These showed high lead in soil and vegetation which extended to Dundas and Leslie Streets. No vegetation injury was found. This was brought to the company's attention in February, 1973 and agreement reached that in-plant traffic would be restricted and a cover built over the scrap piles. The city, to date, have not issued a permit to erect this enclosure.

At this meeting the company estimated that they were six months behind in their program schedule.

cont'd....

A Hi-Vol sampler was set up 50' east of the company property April 15, 1973.

On April 4, 1973, a progress meeting was held with the company. Approvals Section were ready to approve baghouse for calcining furnaces. The company requested the report by the branch on the analysis of the stack testing program. The branch was not clear on some of the results and would check with consultants. The branch stated that it was considering putting the company on A.P.I. list for SO_2 from blast furnace.

On May 9, 1973, the company made a request for an extension on compliance dates claiming that delays in stack sampling and equipment deliveries were the cause. This request was denied on June 20, 1973.

The Air Management Branch agreed to postpone the placement of the company on the A.P.I. list until further stack testing was conducted. This was stated on May 11,1973 at a meeting with the Company.

Air quality results received on May 24, 1973, indicated high dustfall and lead in the area. The report also indicated low zinc, cadmium and copper levels.

On June 25, 1973, further air quality results were received on monitoring from April 15, to May 21, 1973. The comment was that the lead and particulate were high on the hi-vol and dust jars. These were initial results from the hi-vol located at Link-Belt. The hi-vol sampler on the Bruce School had been taken out of service October 2, 1972.

cont'd....

On June 1, 1973, an inspection and meeting at the plant revealed that the lead melting pot exhaust at the Oxide Plant had been ducted to an existing baghouse and that the slag tap on the blast furnace had been ducted to the exhaust system leading into the blast furnace baghouse in accordance with the Certificate of Approval issued for these sources.

Hi-vol results received on July 13, 1973, indicated very high lead levels in ambient air. These results were brought to the attention of the company who agreed to cut production by two-thirds on their calcining furnaces, Oxide Plant. These results and subsequent action were brought to the attention of the Ministry of Health who indicated satisfaction that these were reasonable steps. Shortly thereafter the Company submitted a letter dated July 18, 1973, indicating delivery of a baghouse for the calcining furnaces on August 6, 1973 and installed completely by August 18, 1973. These dates were delayed due to late delivery of the filter bags as a result of the rail strike. The installation was completed September 25, 1973.

On August 8, 1973, five samples from street gutters were taken in the vicinity of the plant and these continue to show a high level trend in lead content.

Dustfall results received during the week of August 13, 1973 reveal a continuing trend of high dustfall and lead in dustfall.

As a result of a company request for an extension to their Program Approval, a Notice of Intent to serve a Control Order was served on the plant on August 20, 1973.

A Control Order was delivered on September 11, 1973. The Order requires that:

> By September 30, 1973, the company pave all in-plant traffic routes and sweep these daily. The tires of all outgoing trucks are to be washed before leaving the premises and a roofed enclosure is to be erected over the lead scrap pile.

cont'd...

By August 31, 1973, the company install a baghouse on the calcining furnaces at the oxide plant.

By November 15, 1973, the company control emissions from the alloying and refining furnaces.

By February 28, 1974, the company control emissions from the blast furnace charging and pouring operations

On September 14, 1973, an inspection of the premises indicated that most of the in-plant roads were paved and clean. The unpaved areas were oiled. Water hoses were being used for truck tire washings. However, a violation notice has been served for a violation of this requirement observed on October 15, 1973.

On September 11, 1973, it was reported in the "Toronto Citizen" that a recently completed University of Toronto study revealed high lead levels in soil in the vicinity of Canada Metal Co.Ltd.

On September 17, 1973, an application was received by the Air Management Branch for a new baghouse for the blast furnace.

The baghouse on the calcining furnaces was installed and placed in operation on September 25, 1973. The Control Order had specified that this be completed by August 31, 1973.

On September 26, 1973, a letter was received from the BREMM citizen's group requesting the results of any surveys conducted in the vicinity of The Canada Metal Co.Ltd. This letter was answered on September 28, 1973.

The Ontario Ministry of Health advised the branch on October 10, 1973, that blood lead sampling program would be implemented in the community "in a few days".

Branch representatives attended a meeting of the Board of Health on October 23, 1973. The Board decided to await the results of the blood sampling program before discussing the matter.

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On October 26, 1973, a letter was sent to The Canada Metal Company Limited, pointing out that a recent inspection of the baghouses revealed certain operational and maintenance deficiencies. The company was requested to take corrective action.

On October 26, 1973, Stop Orders were issued on The Canada Metal Co. Ltd. and Roto-Cast Ltd., on the advice of the Ontario Ministry of Health, on the basis of elevated blood lead levels in three residents of the community. The Stop Orders were served at 4:00 p.m. and by 7:30 a.m., the following morning, all operations at the plant were shutdown.

The companies applied to the Supreme Court of Ontario for a hearing in the matter of the Stop Orders. The hearing was conducted on October 29 and 30, 1973. The court ruled that the Stop Orders were invalid because blood lead levels had not been linked with current plant operations. The court set aside the Stop Orders. On October 30, 1973, the Minister issued a statement in the house regarding the issuance of the Stop Orders.

During an inspection of the plant on October 22, 1973, two violations of the Control Order were observed. Violation Notices were issued for the following;

a) failure to wash truck tires before leaving the property

b) failure to install a roofed enclosure for battery plates

In addition, a violation notice has been served for failure to install a baghouse on the calcining furnaces by the date required in the lead oxide plant.

A legal opinion has been requested as to whether the violation for failure to wash truck tires is prosecutable.

The University of Toronto sent a letter to the Ministry of the Environment on November 12, 1973, outlining the results of their soil surveys:

cont'd.....

On November 12, 1973, a meeting was held with Roto-Cast Ltd., to discuss the emissions from their operations and they were requested to submit production data.

On November 13, 1973, air quality data for the period subsequent to the installation of the baghouse on the calcining furnaces was forwarded to the company and they were requested to investigate two incidents where high values were recorded (October 12, 1973 - 32 ug/m^3; October 24, 1973 - 7.52 ug/m^3).

In a letter to the branch dated November 5, 1973, the company outlined their overall progress and expressed concern that they might not meet the Control Order dates due to the hold up on building permits by the city of Toronto. In a further letter dated November 26, 1973, a detailed construction schedule, based on latest information from the city, was provided, indicating a completion date of April 22, 1974.

cont'd....

SUMMARY

Since 1969 to the present time, the Company has taken the following corrective action;

a) emissions from the lead melting kettle in the lead oxide plant have been ducted to an existing baghouse

b) approximately 60% of the heavily travelled areas in the plant have been paved and are swept daily. Other travelled areas within the plant are controlled by oiling

c) the wheels on outgoing trucks are being washed

d) a baghouse has been installed to control emissions from the calcining furnaces in the lead oxide plant

e) the emissions from the slag tapping operation on the blast furnace have been ducted to an existing baghouse

f) the five largest melting and alloying kettles have been ducted to an existing baghouse on an interim basis

The following items in the control order remain to be completed;

1) the balance of the heavily travelled areas to be paved

2) a roofed enclosure for scrap lead piles to be constructed

3) the slag, lead tap and skip hoist charging areas at the blast furnaces to be controlled by a new baghouse

4) upon completion of the new baghouse for the blast furnace in 3) above, the remaining melting and alloying pots are to be tied into the existing blast furnace baghouse

CED/VS/hy
January 10, 1974

ANNUAL EMISSIONS

THE CANADA METAL CO. LIMITED

As an indication of the longer term situation the following are the estimated yearly emissions in pounds per year.

Compound	As of Nov.1973	Completion of Order
Lead	30000	16000
Silver	2	2
Cadmium Oxide	80	80
Arsenic	460	460

ROTO-CAST LIMITED

LEAD 4,400

A Control Order has not been served to Roto-Cast Limited.

These data are, with the exception of the furnaces, short term values resulting from batch operations.

SUMMARY OF EMISSION DATA

CANADA METAL CO.LTD.
ROTO-CAST LTD.

Contaminant	Pounds per Hour emitted		
	January 1968	November 15, 1973	At completion of Control Order
CANADA METAL CO.LTD.			
Lead and its compounds			
Blast furnace	4.0	4.0	1.3
Slag tap	1.0	-	-
* Reverb Furnace	2.6	-	-
Melting & Alloying	4.8	1.3	1.3
Lead Oxide Plant	1.5	0.5	0.5
Total Lead	13.9	5.8	3.1
Silver	0.08	0.08	0.08
Cadmium Oxide	4.2	0.42	0.42
Arsenic	1.40	1.40	1.40
Sulphur Dioxide	360 **	180	180
Nitrogen Oxides	7.4 **	3.7	3.7
ROTO-CAST LTD			
Lead and its compounds	11.2	11.2	***
TOTAL LEAD FOR PLANT	28.7	17.0	

* Removed from service in 1971

** It is assumed that 180 lb. of SO_2 were emitted from the reverb furnace and 3.7 lbs. of NO_x

*** Roto-Cast are not under a Control Order

ANNUAL EMISSIONS

THE CANADA METAL CO. LIMITED

An an indication of the longer term situation, the following are the estimated yearly emissions in pounds per year.

COMPOUND	AS OF JAN.1968	AS OF NOV. 1973	COMPLETION OF ORDER
Lead	61,220	30,000	16,000
Silver	2	2	2
Cadmium Oxide	800	70	70
Arsenic	460	460	460
SO_2	960,000	950,000	950,000
NO_x	15,762*	15,392*	15,392*

ROTO-CAST LIMITED

Lead	4,400	4,400	---------

* - total of both companies

SUPPORT DATA FOR TABLE ON "SUMMARY OF EMISSIONS DATA"

CANADA METAL COMPANY

BLAST FURNACE

In 1965, in a study completed by the Air Pollution Control Service of Metropolitan Toronto, it was estimated that 200 lb/hr of dust was emitted from the blast furnace. It was further estimated that the baghouse efficiency was 98%. If it is assumed that this is entirely composed of lead compounds, then the emission rate is:

$$Q = \frac{200\ lb}{hr} \times (100\text{-}98\%) = 4\ lb/hr$$

Alternately, if one were to use the E.P.A. emission factor of 190 lb/ton and a baghouse efficiency of 99%, the same emission rate would be arrived at.

The basis for approval for the installation of the new baghouse on the blast furnace was 0.01 grains per cubic feet outlet loading with 60% of the particulate being lead compounds.

$$Q = 0.01\ \frac{gr}{ft^3} \times \frac{lb}{7000\ gr} \times \frac{60}{100} \times 24{,}500\ \frac{ft^3}{min.} \times 60\ \frac{min}{hr}$$

$$= 1.3\ lb/hr.$$

SLAG TAP

Prior to October, 1972, the slag tap emissions were vented to the atmosphere uncontrolled. As there were no emission factors or other data available to calculate the emission rate of lead compounds, an estimate of 1.0 lb/hr was made. In October, 1972, the company ducted these emissions to the baghouse with the result that these emissions are now virtually controlled.

REVERBERATORY FURNACE

Data provided in the E.P.A. Manual A.P. 42 gives an emission factor of 130 lb/ton.

Information in the file indicates that the capacity of the furnace was 24 tons per day. Assuming a baghouse efficiency

cont'd....

of 98% and assuming that in the worst case the particulate is composed entirely of lead compounds, the emission rate is:

$$Q = \frac{24 \text{ tons}}{\text{day}} \times \frac{130 \text{ lb}}{\text{ton}} \times \frac{1 \text{ day}}{24 \text{ hr}} \times \frac{(100-98)}{100} = 2.6 \text{ lb/hr}$$

This furnace was removed from service in 1971.

MELTING AND ALLOYING FURNACES

There are a total of 16 furnaces, however, it is unlikely that all units would be operated at once. Therefore, calculations were based on a typical usage of 2 - 40 ton pots; 2-1 ton pots and 1- 5 ton pot. It would take approximately 16 hours to complete a melt in the 40 ton pots, and 7 hours for the others. Therefore the hourly production rate is:

$\frac{80 \text{ tons}}{16 \text{ hr}}$	=	5 tons/hr
$\frac{7 \text{ tons}}{7 \text{ hr}}$	=	1 ton/hr
TOTAL		6 tons/hr

The E.P.A. Manual A.P. 42 gives an emission factor of 0.8 lb per ton melted. Therefore, the emission rate is:

$$Q = \frac{6 \text{ ton}}{\text{hr}} \times \frac{0.8 \text{ lb}}{\text{ton}} = 4.8 \text{ lb/hr}$$

As of November 15, 1973, the largest pots have been tied into two compartments of the existing baghouse.

The Certificate of Approval for this installation was issued on the basis of 0.01 grains/ft^3 of lead emitted from the baghouse, and a fan capacity of 15,000 cfm.

$$Q = \frac{0.01 \text{ gr}}{\text{cu. ft.}} \times \frac{15{,}000 \text{ cu ft}}{\text{min.}} \times \frac{60 \text{ min}}{\text{hr}} \times \frac{1 \text{ lb}}{7000 \text{ gr}} = 1.3 \text{ lb/hr.}$$

LEAD OXIDE PLANT

At present, 10 baghouses are in use to control process emissions from the various operations. Certificates of Approval were issued for all these sources and the calculations were based on either direct stack testing results (denoted by an asterik) or prorated emissions from these results.

cont'd....

In summary, the emission rates are:

Lead Oxide Plant

*Sly Baghouse (lead melting Pot) (hooding - calcining furnaces)	:	0.07 lb/hr
Baghouse (for Barton Pot #1)	:	0.06 lb/hr
*Baghouse (for Barton Pot #2)	:	0.09 lb/hr
Negative Dracco Baghouse (Bagging Mc#1)	:	0.03 lb/hr
Positive Dracco Baghouse (Bagging Mc#2) (Storage Hopper)	:	0.05 lb/hr
*Main Dracco Baghouse (Bagging Mc#3) (Storage Hopper)	:	0.01 lb/hr
*Ray Mill Baghouse (Raymond Mill Mc)	:	0.002 lb/hr
Stroud Baghouse (#1 Stroud Mill Mc)	:	0.15 lb/hr
Stroud Baghouse (#2 Stroud Mill Mc)	:	0.06 lb/hr
3 Calcining Furnaces	:	.004 lb/hr
		0.5 lb/hr

Prior to September 25, 1973, the calcining furnaces were uncontrolled. This resulted in a total emission rate of 0.7 lb/hr. Prior to June 30, 1972, the lead melting pot at the Barton pots was uncontrolled. Using the E.P.A. emission factor of 0.8 lb/ton, the emission rate from this source alone was calculated to be 0.8 lb/hr on the basis of 1940 lb/hr through put of lead. Therefore, the total emissions from the lead oxide plant were 1.5 lb/hr.

$$Q = \frac{1940 \text{ lb}}{\text{hr}} \times \frac{0.8 \text{ lb}}{2{,}000 \text{ lb}} = 0.8 \text{ lb/hr}$$

SILVER EMISSIONS

The emission rate was derived on the basis of mass balance data provided by the company. In one hour, 420 lbs of silver are melted in a crucible. The molten silver is then poured into a 40 ton kettle of lead and agitated for 3 hours to ensure adequate mixing. As it is considered that the emissions from the crucible represent the worst case with respect to silver emissions, these were put into the emission data summary.

cont'd.....

From calculations completed for a Certificate of Approval for another company, it was found that losses of silver were 0.02% of the total melt. Therefore, the emission rate is:

$$Q = 0.0002 \times \frac{420 \text{ lb}}{1 \text{ hr.}} = 0.08 \text{ lb/hr}$$

This results in a maximum g.l.c. of 2 ug/m^3 by the virtual source technique. As the proposed standard for silver is 3 ug/m^3, technically the company does not have to control this source.

CADMIUM OXIDE EMISSIONS

The emissions of cadmium oxide were calculated from mass balance data provided by the company. The company stated that to produce a typical alloy, 70 lbs of cadmium are added to 40 tons of lead over a 4 hour period. 50.5 lbs of cadmium (m.w. 112.4) are found in the product and 4.8 lbs in the slush. Therefore, it is assumed that the remainder is emitted to the atmosphere, i.e. 14.7 lb. Therefore, the emission rate of cadmium oxide (m.w. = 128.4) is:

$$Q = \frac{14.7 \text{ lb}}{4 \text{ hr.}} \times \frac{128.4}{112.4} = 4.2 \text{ lb/hr}$$

These emissions are now ducted to the baghouse (as of November 15, 1973). The baghouse efficiency for cadmium oxide is not known, but is conservatively estimated at 90%. Therefore:

$$Q = 4.2 \times 0.10 = 0.42 \text{ lb/hr}$$

ARSENIC EMISSIONS

Emission calculations were completed using mass balance data provided by the Company. Approximately 5 tons of $AS_2 O_3$ powder (M. W. 197.82) are mixed with 5 tons of charcoal and added to a 40 ton kettle over a 16 hour period, yielding an 8% by weight arsenic alloy.

$$\text{Arsenic added} = \frac{149.82}{197.82} \times 5 \text{ tons} \times \frac{2000 \text{ lb}}{\text{ton}} = 7570 \text{ lb}$$

$$\text{Arsenic in product} = 0.08 \times 40 \text{ tons} \times \frac{2000 \text{ lb}}{\text{ton}} = 6400 \text{ lb.}$$

cont'd....

Arsenic emissions from kettle = 1170 lb

Assuming a baghouse efficiency of 98%, the emission rate of arsenic is:

$$Q = \frac{1170 \text{ lb}}{16 \text{ hr}} \times \frac{(100-98\%)}{100} = 1.4 \text{ lb/hr}$$

(As $AS_2 O_3$ this would be 1.93 lb/hr)

SULPHUR DIOXIDE

From the E.P.A. Manual A.P. 42, the emission factor for SO_2 from a blast furnace is 90 lb/ton. Therefore, the emission rate is:

$$Q = \frac{48 \text{ ton}}{\text{day}} \times \frac{90 \text{ lb}}{\text{ton}} \times \frac{1 \text{ day}}{24 \text{ hr}} = 180 \text{ lb/hr}$$

It was assumed that 180 lb/hr of SO_2 was also emitted from the reverberatory furnace while it was operating. Thus, the combined emission rate was 360 lb/hr.

NITROGEN OXIDES

Data supplied by the company indicated that in excess of 7.8 million cu ft of natural gas was consumed in one month. Assuming a 16 hr/day and 5 day per week operation, the hourly consumption rate is:

$$\frac{7856125 \text{ ft}^3}{\text{month}} \times \frac{1 \text{ month}}{4.3 \text{ weeks}} \times \frac{1 \text{ week}}{5 \text{ days}} \times \frac{1 \text{ day}}{16 \text{ hr}} = 22{,}600 \text{ ft}^3/\text{hr}$$

From the Air Pollution Engineering Manual P.543, the NO_x emission rate is 3.7 lb/hr. Lacking precise data about the operation of the reverberatory furnace, it was assumed that the emissions would be of the same order. Therefore, the combined emissions were 7.4 lb/hr.

cont'd.....

ROTO-CAST LIMITED

In the Los Angeles County Bureau of Information Circular 7627, the dust loading from an operation of this type is reported to be of the order of 0.061 to 0.32 grains/cu ft. Since all the furnaces could be operated at one time, the maximum grain loading was used to determine the emission rate. The Report further noted that lead could range from 5 to 30% of the total particulate. For the purpose of these calculations, it was assumed that 20% of the particulate would be lead. The exhaust fan capacity is 20,400 c.f.m. Therefore, the emission rate was calculated to be;

$$Q = \frac{0.32 \text{ grains}}{\text{ft}^3} \times \frac{20{,}400 \text{ ft}^3}{\text{min}} \times \frac{1 \text{ lb}}{2000 \text{ gr.}} \times \frac{60 \text{ min}}{1 \text{ hr}} \times \frac{0.20}{}$$

$$= 11.2 \text{ lb/hr}$$

The Company recently supplied production and loss figures and these are currently under review for possible reassessment of emission data.

SUPPORT DATA FOR TABLE ON "ANNUAL EMISSIONS"

(as occurring in January, 1968)

A. LEAD EMISSIONS

(1) CANADA METALS COMPANY LIMITED

Blast Furnace

$$\frac{220 \text{ days}}{\text{year}} \times \frac{24 \text{ hours}}{\text{day}} \times \frac{4 \text{ lb.}}{\text{hour}} = 21{,}120 \text{ lb/yr.}$$

Slag Tap (Blast Furnace)

$$\frac{220 \text{ days}}{\text{year}} \times \frac{24 \text{ hours}}{\text{day}} \times \frac{1 \text{ lb.}}{\text{hour}} = 5{,}280 \text{ lb/yr.}$$

Reverberatory Furnace

We have no data on the time of service that the reverberatory furnace was in January, 1968. However, we do have the monthly usage of natural gas fuel used for the furnace in 1971, just before it was taken out of service. Assuming that the usage was the same in January, 1968, the emissions of oxides were calculated as follows:

126,300 cubic feet of natural gas used per month
Furnace had three burners rated at 5 mm BTU/hr. each.

$$\frac{5{,}000{,}000 \text{ BTU}}{\text{burner} \times \text{hr.}} \times 3 \text{ burners} \times \frac{\text{ft}^3}{1000 \text{ BTU}} = 15{,}000 \text{ ft.}^3 \text{ of } \frac{\text{nat. gas}}{\text{hr.}}$$

$$\frac{126{,}300 \text{ ft.}^3}{15{,}000 \text{ ft.}^3} \times \frac{\text{hr}}{\text{month}} \times \frac{12 \text{ months}}{\text{yr.}} = 100 \frac{\text{hr.}}{\text{yr.}}$$

$$\frac{100 \text{ hr.}}{\text{yr.}} \times \frac{2.6 \text{ lb.}}{\text{hour}} = 260 \text{ lb/yr.}$$

cont'd.....

Melting and Alloying

$$\frac{300 \text{ days}}{\text{year}} \times \frac{24 \text{ hours}}{\text{day}} \times \frac{4.8 \text{ lb}}{\text{hour}} = 34,560 \text{ lb/yr}$$

Total annual lead emissions = 21,120 + 5,280 + 260+34,560
= 61,220 lb/yr

(2) Roto-Cast Limited

From Company records, losses calculated from furnaces = 40,000 lb during a 9 month period. These losses contain 8.3% lead.

Therefore, annual losses =
$0.083 \times 40,000 \times \frac{12}{9} = 4,427$ lb/yr.

B. OTHER EMISSIONS - CANADA METAL

Silver

The draft report on the section 83 survey reveals that the company alloys approximately 6,000 lb of silver per year. For each batch, approximately 420 lb of silver is alloyed into lead and about 0.034 lb. are lost in melting and a further 0.056 lb are lost in alloying.

$$\text{Annual loss} = \frac{6,000 \text{ lb}}{\text{yr.}} \times \frac{(0.084 + 0.056)}{420} = 2.0 \text{ lb/yr}$$

Cadmium Oxide Emissions

Cadmium is alloyed into 40 ton batches of lead. Approximately 70 lb of cadmium charge is added to each lead batch and about 14.7 lb. of cadmium are lost as emissions (uncontrolled in January 1968).

Assuming that alloy production was the same then as in 1972, the annual emission losses, then, were;

$$\frac{3300 \text{ lb of Cd. used}}{\text{year}} \times \frac{14.7 \text{ lb}}{70 \text{ lb.}} \times \frac{128.4}{112.4} = 792 \text{ lb.}$$

cont'd.....

Arsenic Emissions

The draft section 83 report indicates a yearly arsenic usage rate of about 150,000 lb./year. Alloying was done in kettles that had emissions going to the baghouse. For each batch, 7570 lb of As was charged and 1170 were estimated to be emitted to the baghouse which we will assume to have a 98% collection efficiency. Therefore, the annual emissions in January 1968 were:

$$150{,}000 \times \frac{1170}{7570} \times \frac{100 - 98}{100} = 460 \text{ lb/yr}$$

Sulphur Dioxide Emissions

From the E.P.A. Manual A.P. 42, the emission factor for SO_2 from a blast furnace is 90 lb/ton. Therefore, the emission rate is:

$$Q = \frac{48 \text{ ton}}{\text{day}} \times \frac{90 \text{ lb}}{\text{ton}} \times \frac{1 \text{ day}}{24 \text{ hr.}} = 180 \text{ lb/hr.}$$

It was assumed that 180 lb/hr of SO_2 was also emitted from the reverberatory furnace while it was operating. Thus, the combined emission rate was 360 lb/hr.

Blast Furnace:

$$180 \frac{\text{lb}}{\text{hr.}} \times 24 \frac{\text{hr}}{\text{day}} \times 220 \frac{\text{days}}{\text{yr}} = 950{,}400 \text{ lb/yr}$$

Reverberatory Furnace

$$180 \frac{\text{lb}}{\text{hr}} \times 100 \frac{\text{hr}}{\text{yr}} = 18{,}000 \text{ lb/yr}$$

Total = 968,400 lb/yr

Nitrogen Oxides Emissions

Data supplied by the company indicates that in excess of 7.8 million cubic feet of natural gas was consumed in one month. Assuming a 16 hr/day and 5 days per week operation, the hourly consumption rate is:

cont'd.....

$$\frac{7856125 \text{ ft.}^3}{\text{month}} \times \frac{1 \text{ month}}{4.3 \text{ weeks}} \times \frac{1 \text{ week}}{5 \text{ days}} \times \frac{1 \text{ day}}{16 \text{ hr.}} = 22{,}600 \frac{\text{ft.}^3}{\text{hr.}}$$

From the Air Pollution Engineering Manual P. 543, the NO_x emission rate is 3.7 lb/hr. Lacking precise data about the operation of the reverberatory furnace, it was assumed that the emissions would be of the same order. Therefore, the combined emissions were 7.4 lb/hr.

Entire Plants (Roto-Cast and Canada Metal)
Except Reverberatory Furnace of Canada Metal

$$3.7 \frac{\text{lb}}{\text{hr}} \times 16 \frac{\text{hr}}{\text{day}} \times 5 \frac{\text{days}}{\text{week}} \times 52 \frac{\text{week}}{\text{yr.}} = 15{,}392 \text{ lb/yr}$$

Reverberatory Furnace (Canada Metal)

$$3.7 \frac{\text{lb.}}{\text{hr.}} \times 100 \frac{\text{hr}}{\text{yr.}} = 370 \text{ lb/yr}$$

Total = 15,762 lb/yr

JK/ng
January 9, 1974

SUPPORT DATA FOR TABLE ON "ANNUAL EMISSIONS"

LEAD EMISSIONS - CANADA METAL COMPANY

Blast Furnace

$$\frac{220 \text{ days}}{\text{year}} \times \frac{24 \text{ hours}}{\text{day}} \times \frac{4 \text{ lb}}{\text{hour}} = 21{,}120 \text{ lb/year}$$

Melting & Alloying Kettles

$$\frac{300 \text{ days}}{\text{year}} \quad \frac{24 \text{ hours}}{\text{day}} \quad \frac{1.3 \text{ lb}}{\text{hour}} = 9{,}360 \text{ lb/year}$$

Total 30,480

The above represents the conditions at the plant as of November 1973. On completion of the Order, the hourly emission rate of lead will decrease from 5.8 lb/hr to 3.1 lb/hr. Assuming that the yearly losses will be reduced in the same ratio, these will amount to;

$$30{,}480 \times \frac{3.1}{5.8} = 16{,}291 \text{ lb/year}$$

ROTO-CAST LIMITED

From company records, melt losses for the first 9 months of 1973 are:

Total melt losses	: 77,000 lb
Slags and scums (estimated)	: 37,000 lb
Total loss to atmosphere	: 40,000 lb

Data from company indicates the above loss contains 8.3% lead.

Therefore, yearly lead losses are:

$$0.083 \quad 40{,}000 \times \frac{12}{9} = 4{,}427 \text{ lb/year}$$

cont'd....

SILVER EMISSIONS

Data supplied by the company and included in the section 83 report indicates that the company uses 6,000 lb/year of silver. In each batch of 420 lb that are processed in the crucible, 0.084 lbs are lost. A further 0.056 lb are lost in the 40 ton kettle. Therefore, total yearly losses are;

$$\frac{6{,}000 \text{ lb}}{\text{year}} \qquad \frac{(0.084 + 0.056)}{420} \qquad = 2.0 \text{ lb/year}$$

CADMIUM OXIDE EMISSIONS

Data supplied by the company on December 3, 1973 indicates that the company used 3,300 lbs of cadmium in 1972. For each batch of 70 lbs of cadmium added to the pots, 14.7 lbs are emitted to the baghouse. This baghouse is conservatively estimated at 90% efficiency. Therefore:

The yearly emissions (as cadmium oxide) are:

$$\frac{3300 \text{ lb}}{\text{year}} \times \frac{14.7 \text{ lb}}{70 \text{ lb/batch}} \times \frac{128.4}{112.4} \times \frac{(100-90)}{100} \qquad = 80 \text{ lb/year}$$

ARSENIC EMISSIONS

Information provided by the company and contained in the section 83 report indicates a yearly consumption of arsenic of 150,000 lb/year. For each batch of arsenic alloy produced, 7570 lbs of arsenic are added to the molt and of this, 1170 lbs are emitted to the baghouse. Assuming a 98% efficiency for the baghouse, the yearly emission rate of arsenic is:

$$\frac{150{,}000 \text{ lb}}{\text{year}} \times \frac{1170 \text{ lb}}{7570 \text{ lb/batch}} \times \frac{(100-98)}{100} \qquad = 460 \text{ lb/year}$$

Sulphur Dioxide Emissions - Blast Furnace

$$180 \frac{\text{lb.}}{\text{hr.}} \times 24 \frac{\text{hr.}}{\text{day}} \times 220 \frac{\text{days}}{\text{yr.}} = 950{,}000 \text{ lb/yr.}$$

Oxides of Nitrogen Emissions

$$3.7 \frac{\text{lb.}}{\text{hr.}} \times 16 \frac{\text{hr.}}{\text{day}} \times 5 \frac{\text{days}}{\text{wk.}} \times 52 \frac{\text{wks.}}{\text{yr.}} = 15{,}392 \text{ lb/yr.}$$

This figure for NO_X is the total of both companies.

January 10, 1974
JK/hy

Ontario

MINISTRY OF THE ENVIRONMENT

CONTROL ORDER

TO: The Canada Metal Company, Limited,
721 Eastern Avenue,
Toronto, Ontario.

Attention: Mr. Carleton Smith,
President and General Manager

TAKE NOTICE THAT by this Control Order made pursuant to The Environmental Protection Act, 1971, you are hereby ordered:

1. TO take the necessary steps set out below by September 30, 1973;

   a) Pave with a hard surface all in-plant vehicular traffic routes and parking areas, and restrict in-plant vehicles to paved areas.

   b) Sweep and clean all vehicular traffic routes, daily.

   c) Segregate traffic routes for in-plant vehicles from vehicles that move off the property.

   d) Install a wash rack and wash the tires of all vehicles serving the process areas on each occasion that they leave the property.

   e) Install a roofed enclosure for the scrap lead piles.

2. TO take the necessary steps to install and place in continuing operation baghouse systems or alternate equipment of equal or greater efficiency so that by the dates hereinafter set out and thereafter, the emissions of lead and lead compounds from the following will not be in contravention of The Environmental Protection Act, 1971, or regulations made thereunder;

   a) Lead Oxide Plant..... August 31, 1973.

   b) Blast Furnace Facilities

      the skip hoist charging opening and the lead pouring operation..... February 28, 1974.

Cont'd.....

3. To take the necessary steps to install and place in continuing operation a baghouse system or alternate equipment of equal or greater efficiency so that by November 15, 1973 and thereafter, concentrations at a point of impingement either measured or calculated, of lead and lead compounds, silver and silver compounds, and cadmium oxide resulting from emissions from the lead melting, refining and alloying furnaces, in the aggregate, will not be in contravention of The Environmental Protection Act, 1971, or regulations made thereunder.

4. TO take the necessary steps so that by February 28, 1974 and thereafter, the emissions of lead and lead compounds, either measured or calculated, from the property will not, in the aggregate, be in contravention of The Environmental Protection Act, 1971, or regulations made thereunder.

5. Pending implementation of this control order, the Company will take all steps necessary to minimize air pollution.

6. All parts of this control order refer to operations and equipment of the Company on its property located at 721 Eastern Avenue, in the Municipality of Metropolitan Toronto, Ontario.

T.W. Clow

C.J. Macfarlane,
Director,
Air Management Branch.

Dated at Toronto this 7th

day of September, 1973.

SECTION 5.2

PHYTOTOXICOLOGY REPORTS ON

CANADA METAL COMPANY LIMITED
771 Eastern Avenue, Toronto

Dr. S.N. Linzon
Chief, Phytotoxicology Section

INDEX TO SECTION 5.2

PHYTOTOXICOLOGY SECTION
AIR MANAGEMENT BRANCH

INVESTIGATION SUMMARY REPORT

Location TORONTO

Date(s) of Investigation Sept. 20-22/72; Sept. 17/73; Oct. 29/73; Nov. 2,5,6/73;Nov.19-20/73

Source CANADA METAL CO. LTD., 721 EASTERN AVE.

Nature of Investigation LEAD SURVEYS (SOILS AND VEGETATION)

Analyses Results (Tables, Maps, Sketches attached)

Attached are final reports for all surveys conducted in 1972 and 1973. These reports tabulate and discuss the analytical results. Preliminary reports which provide details on purposes of surveys, samples collected, and sample locations with maps are on file.

The key conclusions of these surveys are:

1. A survey conducted in September 1972 at 10 locations in the vicinity of Canada Metal demonstrated exceedingly high lead contents in surface soil (8,250 ppm) and in not washed vegetation (1800 ppm) at a distance of 200 feet north of the company. The not washed foliar samples possessed two to three times the amount of lead in washed samples indicating the presence of a high proportion of airborne particulate lead. Lead levels in vegetation decreased with distance to the northeast from the company.

2. The September 1972 survey was repeated one year later and the results showed similar trends in lead contents in soil and vegetation at the 10 locations in the vicinity of Canada Metal Co.

3. In November 1973, the survey was expanded to examine soil and vegetation at 40 stations in the vicinity of Canada Metals and at 11 control stations in the vicinity of the Gardiner Expressway in an area removed from the influence of industrial sources of lead. Excessive levels of lead were found in soil and in individual species of vegetation in residential areas to a distance of 1500 feet northeast of the company. Statistically significant decreases in lead content in both soil and vegetation were shown with increasing distances from Canada Metals to the north and northwest. No excessive levels of lead were found in vegetation in the control area. Although higher than normal levels of lead were found in control soil samples off the Gardiner Expressway, the levels were considerably lower than those found near Canada Metal, particularly to the south of the company.

4. An additional soil survey to indicate depth and extent of lead contamination in the vicinity of Canada Metal was conducted in November, 1973. Soil contamination isopleths were drawn on a map showing the areas north of the company possessing over 500 ppm lead in soil to various depths.

Complaint: Ext. _____

Int. XX

Surveillance _____

PHYTOTOXICOLOGY SECTION
AIR MANAGEMENT BRANCH

INVESTIGATION FINAL REPORT

Location TORONTO

Date(s) of Investigation September 20-22, 1972

Source Canada Metals Co.

Complaint Requested by Abatement Section

ature of Investigation Soil and Vegetation Survey for Lead Contamination

Description of Investigation

This survey consisted of sampling Ailanthus trees, a shrub, and soil from the 0-2 and 2-4 inch depths from 10 locations to the N, NE, E, SW and NW of the plant. A map showing the location of each sampling site is attached.

Observation and Results

Canada Metals is located in a heavily industrialized area. Other possible sources of contamination in the area include: Link-Belt ltd., on Leslie Street; A.R.Clark, a tannery; Toronto Iron Works, a foundry; and the Lakeshore and Gardiner Expressways. However, no air pollution injury symptoms were observed on vegetation anywhere in the area, although most of the vegetation showed evidence of dust deposits. The dust was heaviest on the south side of Eastern Avenue in front of A.R. Clark's. Some of the foliage and soil samples were collected from exposed sites (station 1, all samples; station 3, soil; station 4, honeysuckle; station 5, all samples; station 9, all samples; station 10, all samples) and the others were more or less protected by surrounding buildings and vegetation.

The lead content of all samples is shown in Table 1. With one exception excessive levels of lead were detected in the washed foliage collected from Ailanthus trees and shrubs at all sampling locations.

The lead levels were highest in the samples collected close to the plant and decreased with increasing sampling distance to the north and northeast of the source. Both the Ailanthus and shrub foliage not washed samples had two to three times the amount of lead as washed samples, indicating that significant proportions of the airborne lead was present in the particulate form. By comparison, lead contamination from vehicular traffic is in more of an aerosol form and the average lead concentration in not-washed vegetation throughout Metro Toronto is less than twice the washed concentration.

The lead content of soil collected from the 0-2 and 2-4 inch depths was found to be excessive at all sampling stations, and generally, was highest in the surface layer.

cont'd.....

Summary

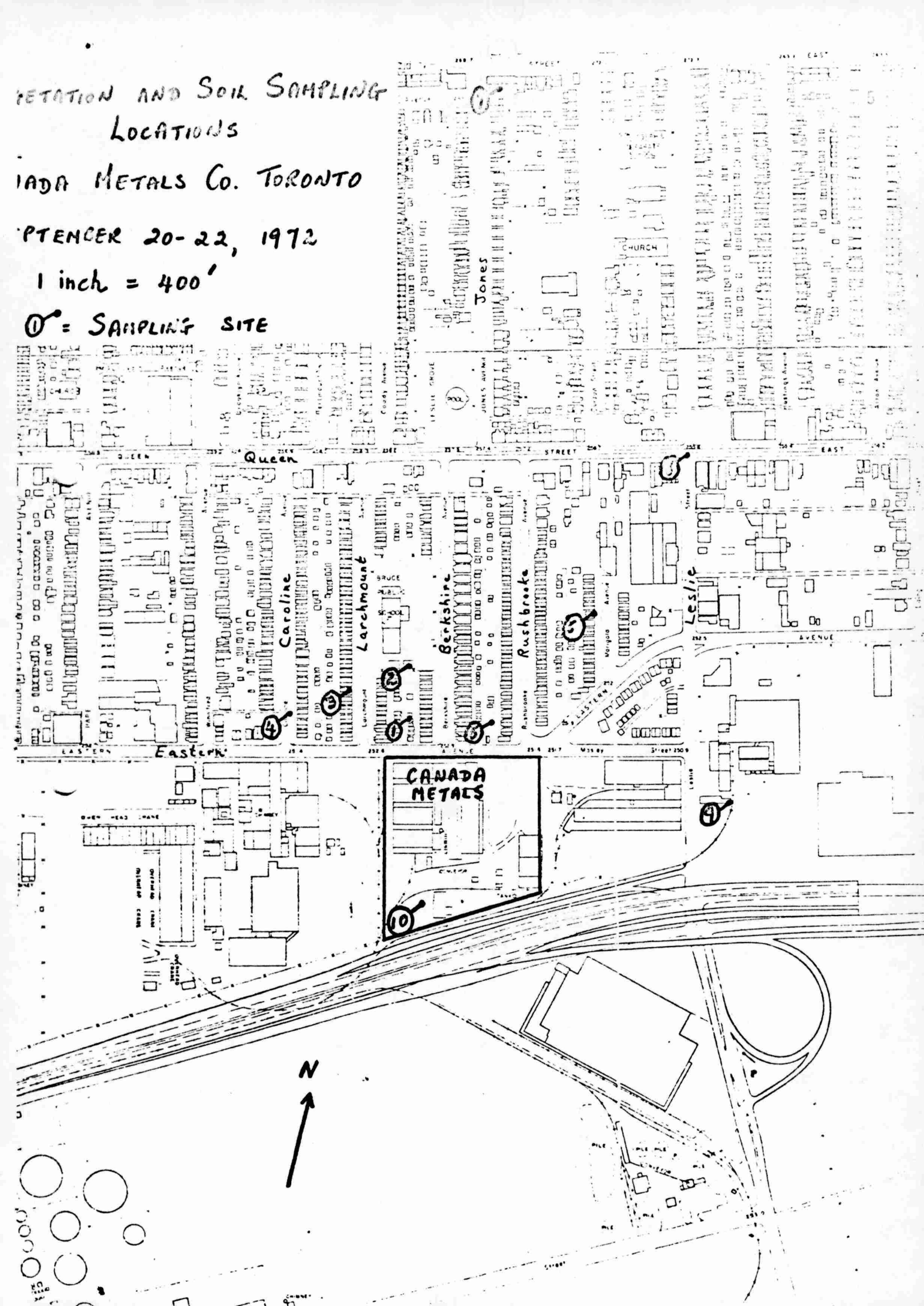
Excessive levels of lead were detected in soil and vegetation collected in the vicinity of the Canada Metals plant. This contamination extended to Dundas Street to the north and Leslie Street to the east of the source.

TABLE I

Lead Content of Vegetation and Soil
Vicinity of Canada Metals Co., Toronto
September 20-22, 1973

Station No.	Distance and Direction	Lead Content (ppm - dry weight)					
		Ailanthus		Shrub		Soil	
		NW	W	NW	W	0-2	2-4
1	200' N	1800	900	870	350 (L)	8250	5750
2	400' N	185	100	280	150 (H)	1000	550
7	2500' N	115	76	-	-	-	-
5	200' NE	600	290	570	300 (L)	1030	1000
6	1000' NE	220	260	140	150 (L)	3080	3500
8	1800' NE	135	47	175	95 (L)	1000	750
9	1700' E	320	170	-	-	7630	2000
10	500' SSW	500	270	-	-	800	600
3	600' NW	190	130	350	150 (P)	5000	2500
4	1000' WNW	410	180	1200	420 (H)	4880	2500
Control	1.3 mile NE	53	38	45 63	45 (L) 48 (H)	120	85

NW - not washed
W - washed
(L) - lilac
(H) - honeysuckle
(P) - privet


ETATION AND SOIL SAMPLING
LOCATIONS
IADA METALS CO. TORONTO
PTEMBER 20-22, 1972
1 inch = 400'
= SAMPLING SITE
Queen
Jones
CHURCH
Caroline
Larchmount
Berkshire
Rushbrooke
Leslie
Eastern
CANADA METALS
N

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Int. XX

Surveillance

PHYTOTOXICOLOGY SECTION
AIR MANAGEMENT BRANCH

INVESTIGATION FINAL REPORT

Location TORONTO

Date(s) of Investigation September 17, 1973

Source Canada Metals

Complaint Survey requested by Abatement Section, AMB
Mr. J. Baranowski, 29 Caroline Ave.

Nature of Investigation Vegetation and Soil Survey and Complaint Investigation

Description of Investigation

Soil and Vegetation Survey

This survey was conducted to determine the degree and extent of lead contamination of soil and vegetation in the vicinity of the Canada Metals plant. Sampling of Ailanthus or maple, lilac or substitute shrub and soil at depths of 0-2 and 2-4 inches was conducted at the same time of the year (September) and from the same locations as the previous 1972 survey. Additional sampling sites were located along Berkshire Avenue, north of the source, and in Leslie Grove Park, along Queen Street. The location of all sampling sites is shown in the attached map.

Complaint Investigation

A complaint concerning possible lead contamination of fruit was received from Mr. J. Baranowski at 29 Caroline Ave and was investigated during this survey.

Observations and Results

Lead Content of Vegetation

The chemical analyses results for tree and shrub foliage are given in Table IA. Elevated lead levels were found in all vegetation samples collected south of Queen St., between Leslie St. and Winnifred Avenue. Highest lead levels were found in vegetation growing directly north and northeast of Canada Metals, and lead levels decreased with increasing distances away from the lead plant. Samples of maple foliage collected along Berkshire Avenue, north of the plant were compared with similar samples collected near the Gardiner Expressway and with the average lead content of maple foliage in Metro Toronto (Table IB). These results showed that lead levels decreased with increasing distance from the source, and that the lead content of maple foliage collected 300 feet north of Canada Metals was 1.5 times higher than that of maples growing next to the Gardiner Expressway.

No visible air pollution injury symptoms were observed on vegetation growing in the area.

cont'd.....

Lead Content of Soil

Lead analyses of soil collected in the vicinity of Canada Metals are shown in Table 2. Significant lead contamination was found in all soil samples collected south of Queen St., between Leslie and Winnifred. This pattern of contamination was similar to that found in vegetation samples. As with vegetation, lead levels in soil decreased with increasing distances away from the Canada Metals plant. The upper two inches of soil had significantly greater amounts of lead in the contaminated zone than lower levels of soil, indicating atmospheric transport of the lead.

Comparison of 1972 and 1973 Results

A comparison of lead levels in vegetation and soil collected at the same locations in 1972 and 1973 is given in Table 3. Lead levels in Ailanthus and shrub foliage were unchanged from last year to the present year. Soil lead levels were highly variable, but no discernable trends, either decreasing or increasing, could be observed as a whole.

Complaint Investigation

The lead content of the samples of tomato foliage, fruit, and soil is shown in Table 4. The lead content of both soil and tomato foliage were significantly higher than normal. However, the lead content of the tomato fruit was well below the maximum acceptable limit of 7 parts per million, as established by the Health Protection Branch of the federal government.

Summary

1. Significant lead contamination of vegetation and soil was found in the vicinity of Canada Metals, from Leslie St. on the east, north to Queen St. and west to Winnifred St. Within this area, lead contents of vegetation and soil decreased with increasing distances from the lead plant.

2. Lead levels in vegetation and soil collected in September 1973, were similar to the levels found from specimens in the same sampling sites obtained in September, 1972.

3. Garden soil and tomato foliage collected 600 feet northwest of the lead plant were contaminated with lead, but tomato fruit had a lead content below the maximum acceptable limit for lead in fresh fruit.

TABLE I

LEAD CONTENT OF VEGETATION COLLECTED AROUND
CANADA METALS, SEPTEMBER 17, 1973

A. Surveillance stations:

Station No.	Location	Lead Content (ppm - dry weight)			
		Ailanthus		Shrub	
		NW	W	NW	W
1	325' N	886	842	724	421
2	550' N	298	142	291	153
3	500' NW	337	194	179	79
4	700' NW	287	168	546	313
5	300' NE	556	329	435	309
6	750' NE	234	109	522	359
7	2000' N	98	45	87	42
8	1200' NE	111	57	181	71
9	900' E	265	190	-	-*
10	400' S	431	272	-	-
Control	3 miles W	82	37	83	49

* Shrub not available for sampling

B. Maple foliage:

Location of Sample	Lead Content (ppm- dry weight)	
	NW	W
300' N of Canada Metals	169	68
800' " "	92	77
1300' N " "	37	37
10' S of Gardiner Expy. at Bay St.	76	47
Metro Toronto Average	63	38

NW - not washed

W - washed

TABLE 2

LEAD CONTENT OF SOILS COLLECTED AROUND

CANADA METALS LTD., SEPTEMBER 17, 1973

Station	Location	Lead Content of Soil (ppm-dry weight)	
		0-2"	2-4"
1	325' N	2980	2700
2	550' N	1570	813
3	500' NW	2610	1710
4	700' NW	2470	2280
5	300' NE	3390	1620
6	750' NE	3310	2370
7	2000' N	218	238
8	1200' NE	665	695
9	900' E	2110	1300
10	400' S	765	510
CONTROL	3 miles W	225	200

TABLE 3

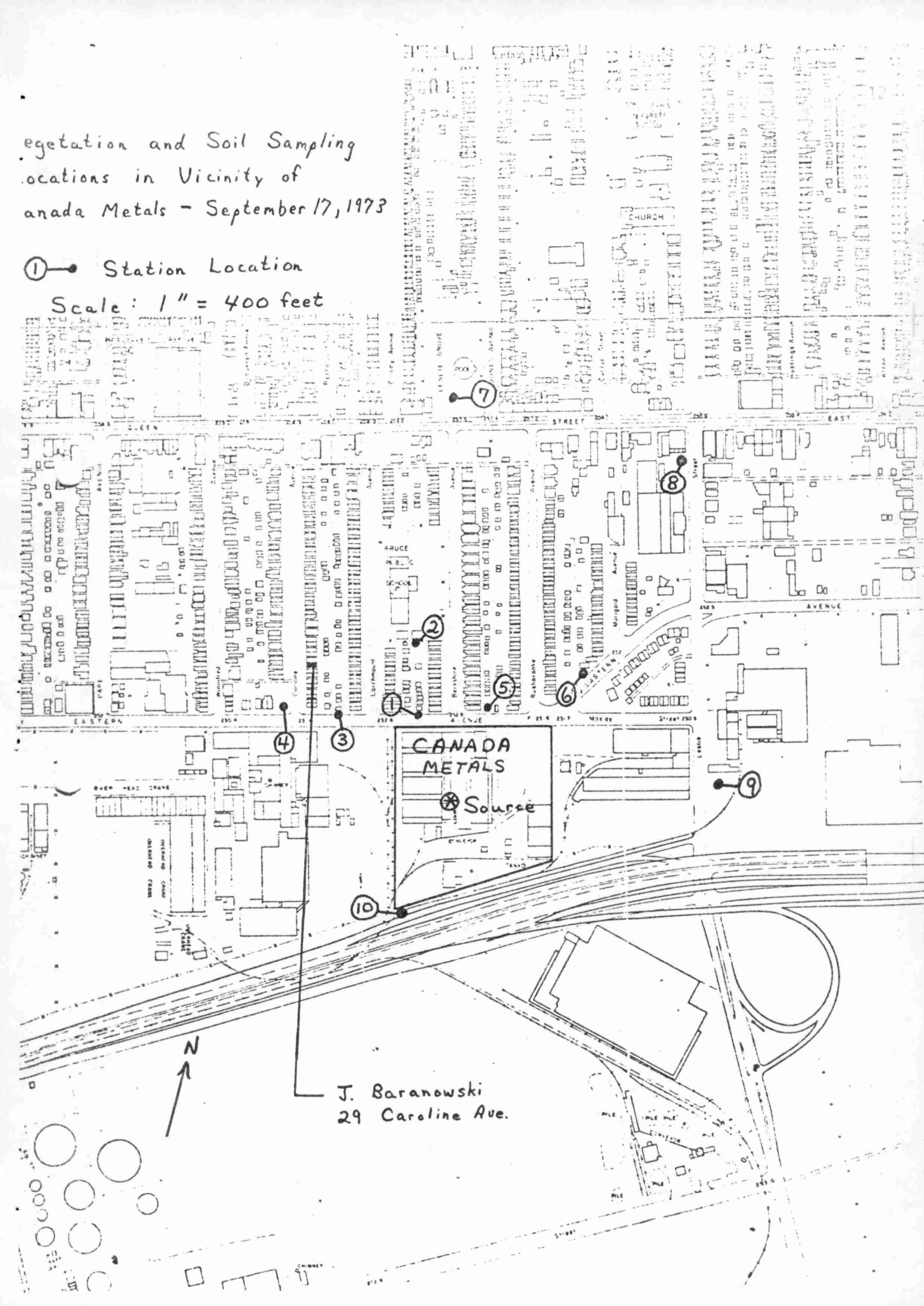
LEAD CONTENTS OF WASHED VEGETATION AND SOIL
0-2" COLLECTED AROUND CANADA METALS
IN SEPTEMBER 1972 AND SEPTEMBER 1973

Station No.	Location	Lead Content (ppm - dry weight)					
		Ailanthus		Shrub		Soil	
		1973	1972	1973	1972	1973	1972
1	325' N	842	900	421	350	2980	8250
2	550' N	142	100	153	150	1570	-
3	500' NW	194	130	79	150	2610	5000
4	700' NW	168	180	313	420	2470	4880
5	300' NE	329	290	309	300	3390	1030
6	750' NE	109	260	359	150	3310	3080
7	2000' N	45	76	42	-	218	-
8	1200' NE	57	47	71	95	665	1000
9	900' E	190	170	-	-	2110	7630
10	400' S	272	270	-	-	765	800
Control	3 miles W	37	38	-	-	225	365

TABLE 4

LEAD CONTENT OF SAMPLES COLLECTED
IN GARDEN ON COMPLAINANT PROPERTY, 29 CAROLINE AVE.
600 FEET NORTHWEST OF CANADA METALS,
SEPTEMBER 17, 1973

SAMPLE	LEAD CONTENT - PPM	
	NW	W
Tomato fruit (fresh weight)	0.2	0.2
Tomato leaves(dry weight)	129	61
Soil 0-2 inches (dry weight)	1640	-
Soil 2-4 inches (dry weight)	1640	-


egetation and Soil Sampling
ocations in Vicinity of
anada Metals - September 17, 1973
① Station Location
Scale: 1" = 400 feet
CANADA METALS
Source
J. Baranowski
29 Caroline Ave.
N
CHURCH
QUEEN
STREET
EAST
AVENUE
BRUCE
EASTERN
CAROLINE

Complaint: Ext. _____

Int. XX

Surveillance _____

PHYTOTOXICOLOGY SECTION
AIR MANAGEMENT BRANCH

INVESTIGATION FINAL REPORT

Location TORONTO

Date(s) of Investigation October 29, 1973

Source CANADA METAL CO. LTD.

Complaint Requested by Abatement Section

Nature of Investigation Soil and Vegetation Sampling - High Blood Levels

Description of Investigation

Samples of soil and vegetation were collected at the properties of three residents in the vicinity of the plant whose blood showed high levels of lead in a first sampling program. The location of each site is shown on the attached map. Samples were collected at the front and back of each property.

Results

Table I shows the degree of contamination of surface soil and vegetation at each of the three residences where high lead levels in the blood were determined in a first test.

TABLE I

DEGREE OF CONTAMINATION OF SURFACE SOIL AND VEGETATION
AT THREE RESIDENCES IN THE VICINITY OF CANADA METAL

Residence	Lead (ppm, dry wt.)			
	Back of House		Front of House	
	surface soil 0-2"	vegetation not washed	surface soil 0-2"	vegetation not washed
49 Jones	750	160	550	-
61 Rushbrooke	390	340	420	268
866 Eastern	620	248	1150	59

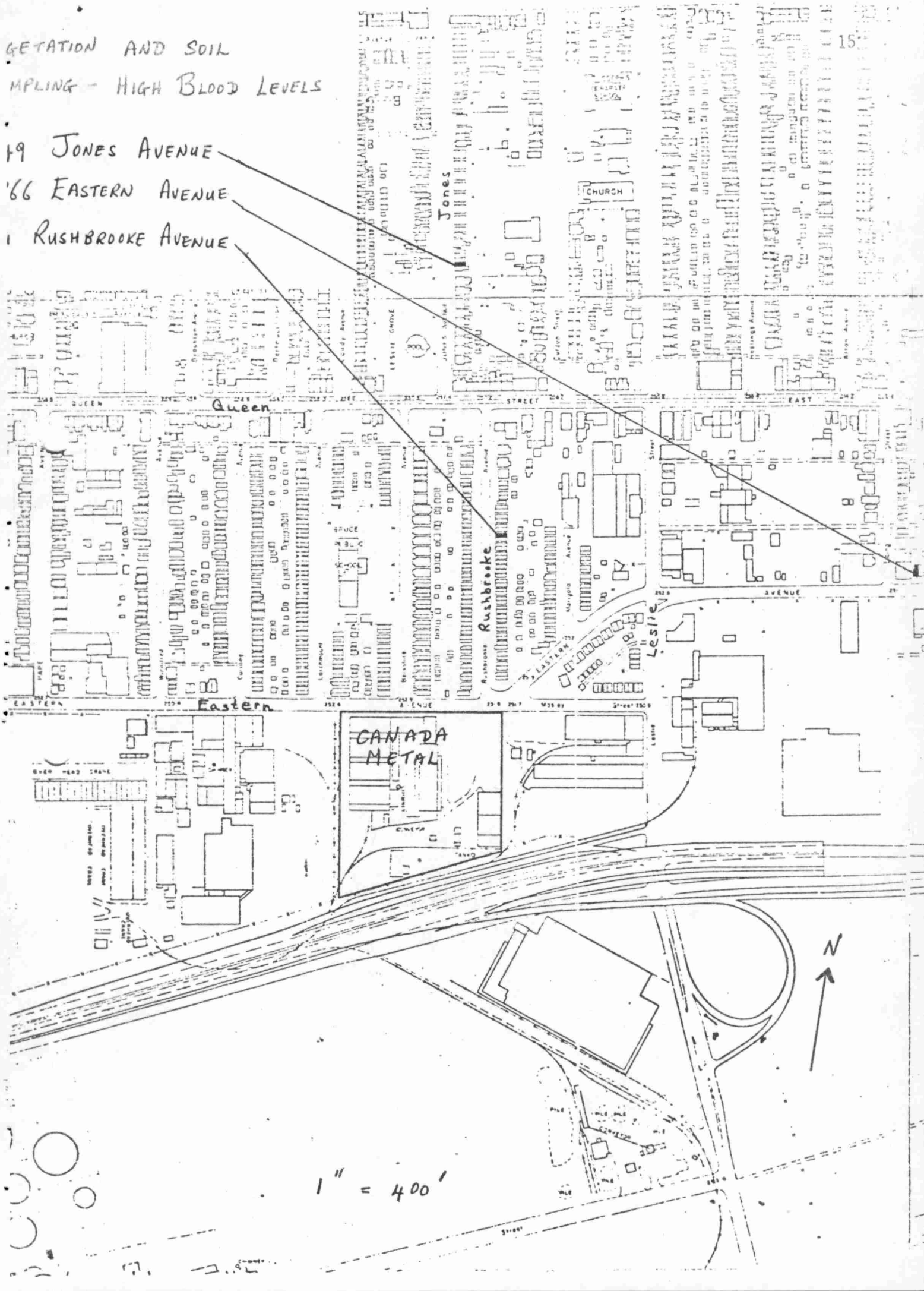
GETATION AND SOIL

MPLING – HIGH BLOOD LEVELS

19 JONES AVENUE

'66 EASTERN AVENUE

1 RUSHBROOKE AVENUE



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Int. _____

Surveillance XX

PHYTOTOXICOLOGY SECTION
AIR MANAGEMENT BRANCH

INVESTIGATION FINAL REPORT

Location TORONTO

Date(s) of Investigation November 2,5,6/73

Source Canada Metal Co. Ltd.

Complaint Surveillance Study

Nature of Investigation Vegetation & Soil Survey to Determine Extent of Lead Contamination

Description of Investigation

See attached

Description of Investigation

An intensive survey of soil and vegetation was undertaken in order to define the extent of lead contamination in the vicinity of the plant. Samples of soil, at depths of 0-2 inches and 2-4 inches, and available vegetation (tree, shrub, grass) were collected at 300-foot intervals along eight directional lines radiating out from the plant: N, NE, E, SE, S, SW, W, NW. The locations of these sampling stations are shown in Fig.1. Because of the heavily industrialized area to the S of Eastern Avenue, it was not possible to make collections at Stations 26 and 31. In addition to sampling in the vicinity of the plant, control samples were collected on a line running N and S of the Gardiner Expressway in the Exhibition Park area, based on a simulated source having the same position relative to the expressway as the actual Canada Metals plant.

Half of each vegetation sample was washed prior to chemical analysis, and the remainder was analyzed unwashed.

Results of Chemical Analysis

1. Lead Content of Vegetation.

The results of the chemical analysis for lead content of tree and shrub foliage are shown in Table 1. These results indicate a definite trend of reduced lead content in vegetation with increasing distance from the source. Along the radii running NE, N, NW and SW from the plant, it was possible to collect similar species of trees and shrubs at most stations. Consequently, the correlation between lead content of tree and shrub foliage and distance from the source was statistically significant for both washed and not washed samples collected along these radii.

The poor correlations in the other directions (E, W, S, SE) can be attributed to the difficulty in locating species common to all sampling locations. Because vegetation was not plentiful to the S, SE, and W of the plant, as well as the fact that autumn defoliation of many species had already occurred by the date of the survey, the choice of species from which samples could be obtained was greatly reduced. These factors are important in that different plant species show considerable variation in ability to accumulate airborne lead. However, the general trend of reduced lead content in vegetation with increasing distance from the source is still evident along three of these radii (E, S, and SE) when the lead contents of grass samples are examined. The correlation between lead content of grass and distance from the source is significant for both washed and not washed samples collected E of the plant, and significant for not washed samples collected S and SE of the plant.

Figure 2 shows zones of lead contamination in tree and shrub foliage (washed samples) in the vicinity of Canada Metals. Extremely high levels of lead (greater than 150 ppm) in vegetation were detected in the immediate vicinity of the plant in all directions. Lead levels considered excessive (greater than 75 ppm) were detected in an area which extended approximately 500 feet to the N and NW of the plant, 800 feet to the W and NE of the plant, and over 1200 feet to the E of the plant. Sampling stations were not extended far enough to the S and SE of the plant to define the boundary of the contaminated zone in these directions.

2. Lead Content of Soil

Lead levels in soil samples collected in the vicinity of Canada Metals are shown in Table 2. The trend of reduced lead content with increasing distance is evident in all directions except W and SW. The correlation between lead content in the 0-2" layer of soil and distance from the source is statistically significant for samples collected to the N, NW and S of the plant.

Probable causes of poor correlation in the other directions are the sheltering influence of buildings and the effect of street traffic. The lead content of soil to the W of the plant is still high at a distance of 1500 feet. Heavy traffic on Eastern Avenue may be a contributing factor in the wide distribution of lead-contaminated dust in this direction.

Figure 3 shows isopleths of lead content in soil(0-2")depth in the vicinity of Canada Metals. The 1000 ppm isopleth indicates the area in which extremely high lead levels were found in soil. It can be seen that this area extends 500 feet to the N and NW of the plant, and nearly 1500 feet to the NE, E, and SE. Sampling stations were not extended far enough to the S and SW of the source in order to completely define this area of extremely high contamination (greater than 1000 ppm). This survey did not cover an area large enough to permit the delineation of a zone of excessive (> 600 ppm) levels of lead in soil.

3. Comparison with Control Samples (Gardiner Expressway)

Control samples for the Canada Metals survey were collected in the Exhibition Park area, an area removed from the influence of industrial sources of lead. A simulated source was located on Jefferson Avenue the same distance N of the Gardiner Expressway as the Canada Metal Co. on Eastern Avenue. Using this hypothetical position as a base, samples were collected at 300-foot intervals to the N and S of the assumed source in the same manner as sampling was carried out in the vicinity of Canada Metals. This control survey was designed to determine if vehicle emissions from an elevated expressway could be significant in contributing to higher than normal lead levels as found in the vicinity of Canada Metals. The locations of the control stations are shown in Fig. 4.

Table 3 shows a comparison of results between the two areas with respect to lead content in vegetation and soil. In examining these results it must be noted that the Gardiner Expressway is located at a distance approximately 700 feet S of Canada Metals and the same distance S of the simulated source in the control area.

It can be seen from these results that washed vegetation samples collected in the control area did not exceed 75 ppm,indicating that vegetation in the control area does not contain higher than normal levels of lead. In contrast, several samples of washed vegetation collected in the vicinity of Canada Metals at comparable distances from the Expressway contained greater than 75 ppm lead,particularly to the S of the plant.

There is a noticeable decrease in lead content in vegetation with increasing distance from the Gardiner Expressway in the control area, but the values do not approach the high levels found in vegetation surrounding Canada Metal Co. This indicates that vehicle emissions alone could not account for the high lead content in vegetation in the vicinity of Canada Metal.

Soil samples (0-2") collected in the control area contain higher than normal levels of lead at the following station: 300 feet S, 300 and 600 feet N, and 1500 feet N. However, the levels at these locations are still considerably less than the lead content of soil (0-2") collected in the vicinity of Canada Metals, particularly to the S of the plant. Consequently, the high lead content in soil near Canada Metals cannot be attributed to vehicle emissions.

Summary

1. Vegetation samples collected in the vicinity of Canada Metal Co. Ltd. contained excessive amounts of lead up to 500 feet N and NW of the plant, 800 feet W and NE, 1200 feet E, and to an undefined distance greater than 1500 feet S and SE of the plant.

2. Lead content of vegetation tends to decrease with increasing distance from the source. A statistically significant correlation between lead content of vegetation and distance from Canada Metals was found for one or both of foliage (tree and shrub) and grass in all directions from the plant except to the W.

3. Soil samples collected in the vicinity of Canada Metal Co. Ltd. contained extremely high levels of lead in the 0-2 inch depth for a distance up to 500 feet N and NW of the plant, close to 1500 feet NE, E, and SE, and to an undefined distance greater than 1500 feet to the S and SW.

4. The correlation between lead content of soil (0-2") and distance from Canada Metals was statistically significant for samples collected N, NW, and S of the plant. The sheltering influence of buildings and effect of street traffic on re-suspension of lead-contaminated dust are probable factors accounting for poor correlation in the other directions.

5. Control samples collected in the vicinity of the Gardiner Expressway but isolated from industrial sources of lead indicated that excessive lead levels in soil and vegetation in the vicinity of Canada Metals could not be attributed to vehicle emissions from traffic on the Expressway.

TABLE I

AVERAGE LEAD LEVELS IN WASHED AND NOT WASHED VEGETATION
COLLECTED IN VICINITY OF CANADA METALS
IN PARTS PER MILLION, DRY WEIGHT,
(NOVEMBER 2,5 AND 6/73)

Distance from Source	Direction															
	E		NE		N		NW		W		SW		S		SE	
	NW	W	NW	W	NW	W	NW	W	NW	W	NW	W	NW	W	NW	W
A. Tree and Shrub Foliage																
300'	258	183	451	308	94	90	145	123	108	77	-	-	-	-	268	400
600'	355	303	186	108	75	62	53	34	82	54	199	139	3530	2740	-	-
900'	167	115	33	32	59	50	40	35	96	72	143	92	105	123	480	290
1200'	-	-	121	61	39	25	52	34	-	-	54	54	-	-	138	122
1500'	63	60	90	54	53	31	26	30	81	72	117	86	123	108	-	-
1800'	-	-	43	35	-	-	-	-	-	-	63	60	-	-	-	-
Correlation Coefficient r=	-0.73	-0.60	-0.89**	-0.89**	-0.93**	-0.97**	-0.90*	-0.86*	-0.74	-0.07	-0.84*	-0.84*	-0.83	-0.83	-0.06	-0.90
B. Forage (grass)																
300'	-	-	111	42	159	112	119	26	287	134	-	-	-	-	-	-
600'	357	281	83	62	58	15	69	25	230	98	122	84	568	104	320	430
900'	139	98	42	20	413	102	62	29	275	143	18	18	305	219	183	156
1200'	131	37	135	42	-	-	29	24	55	25	37	19	94	61	-	-
1500'	78	37	79	46	25	34	41	28	51	24	22	16	62	41	103	101
1800'	-	-	-	-	-	-	-	-	-	-	44	21	-	-	-	-
Correlation Coefficient r=	-0.93*	-0.94*	-0.14	-0.15	-0.06	-0.47	-0.96**	-0.22	-0.90	-0.74	-0.68	-0.79	-0.98**	-0.48	-0.98*	-0.91

* Significant at 5% level ** Significant at 1% level

TABLE 2

LEAD CONTENT OF SOIL COLLECTED IN VICINITY OF CANADA METALS
IN PARTS PER MILLION, DRY WEIGHT
(NOVEMBER 2,5, AND 6/73)

Distance from Source	Direction															
	E		NE		N		NW		W		SW		S		SE	
	0-2"	2-4"	0-2"	2-4"	0-2"	2-4"	0-2"	2-4"	0-2"	2-4"	0-2"	2-4"	0-2"	2-4"	0-2"	2-4"
300'	5380	6200	1350	1360	1100	863	1210	1830	1920	1710	-	-	-	-	8580	-
600'	1650	1660	2440	1660	505	385	538	445	3600	3400	5700	3030	21200	555	13400	12400
900'	2300	2260	770	755	810	728	445	335	1140	1360	620	418	9700	7880	943	175
1200'	4650	795	1590	1350	133	135	415	318	1920	733	378	205	1990	1950	605	220
1500'	613	83	663	368	320	243	240	223	1090	1100	720	608	1180	495	378	145
1800'	-	-	318	195	-	-	-	-	-	-	2090	1310	-	-	-	-
Correlation Coefficient r=	-0.56	-0.93**	-0.57	-0.73	-0.82*	-0.77	-0.95**	-0.90*	-0.42	-0.50	-0.63	-0.58	-0.98**	-0.12	-0.74	-0.85

Metro Toronto Average 0-1" 291
4-6" 148

*Significant at 5% level
**Significant at 1% level

TABLE 3

COMPARISON BETWEEN CANADA METAL AREA AND CONTROL AREA
WITH RESPECT TO LEAD CONTENT (PPM-DRY WEIGHT)
OF VEGETATION AND SOIL

Distance and Direction from Source (Simulated Source in Control)	Foliage				Forage (Grass)				Soil			
	Control Stations		Canada Metal Stations		Control Stations		Canada Metal Stations		Control Stations		Canada Metal Stations	
	NW	W	NW	W	NW	W	NW	W	0-2"	2-4"	0-2"	2-4"
1500 feet N	32	23	53	31	23	20	25	34	610	338	320	243
1200 feet N	44	33	39	25	42	20	-	-	403	413	133	135
900 feet N	77	56	59	50	34	21	413	102	240	180	810	728
600 feet N	50	50	75	62	42	31	58	15	743	568	505	385
300 feet N	-	-	94	90	36	23	159	112	583	610	1100	863
300 feet S	79	63	-	-	24	20	-	-	648	388	-	-
600 feet S	-	-	3530	2740	64	48	568	104	160	113	21200	555
700 feet S	Location of Gardiner Expressway											
900 feet S	67	75	105	123	-	-	305	219	183	153	9700	7880
1200 feet S	27	18	-	-	-	-	94	61	93	55	1990	1950
1500 feet S	18	18	123	108	23	23	62	41	80	43	1180	495

Fig. 1

Vegetation and Soil Sampling Locations in Vicinity of Canada Metal Co.

November 2, 5, and 6, 1973

① Station Location

Scale: 1" = 400 feet

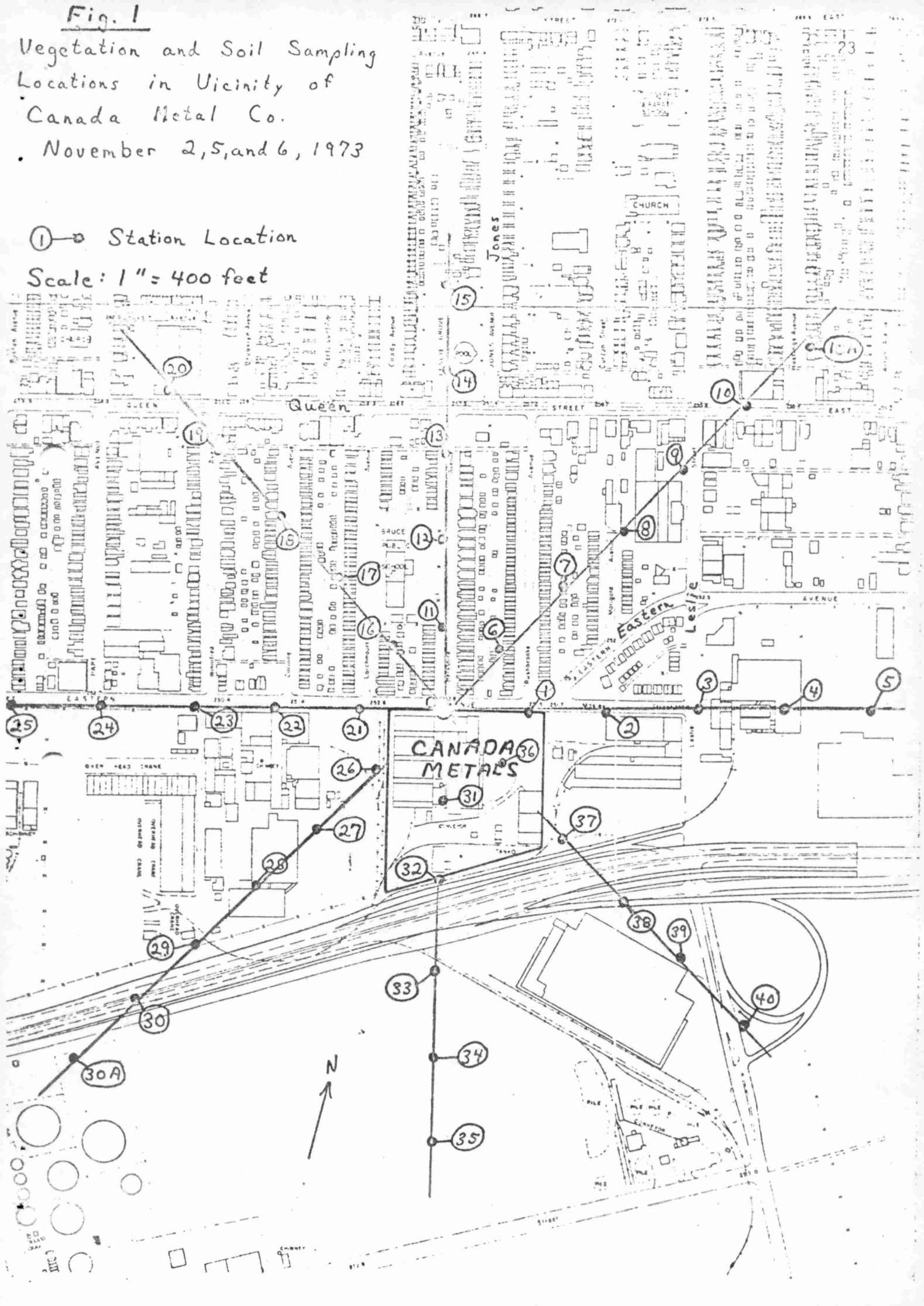


Fig. 2

Zones of Lead Contamination in Washed Vegetation in Vicinity of Canada Metals

Units are ppm
(Based on results from tree and shrub foliage)

Scale: 1" = 400 feet

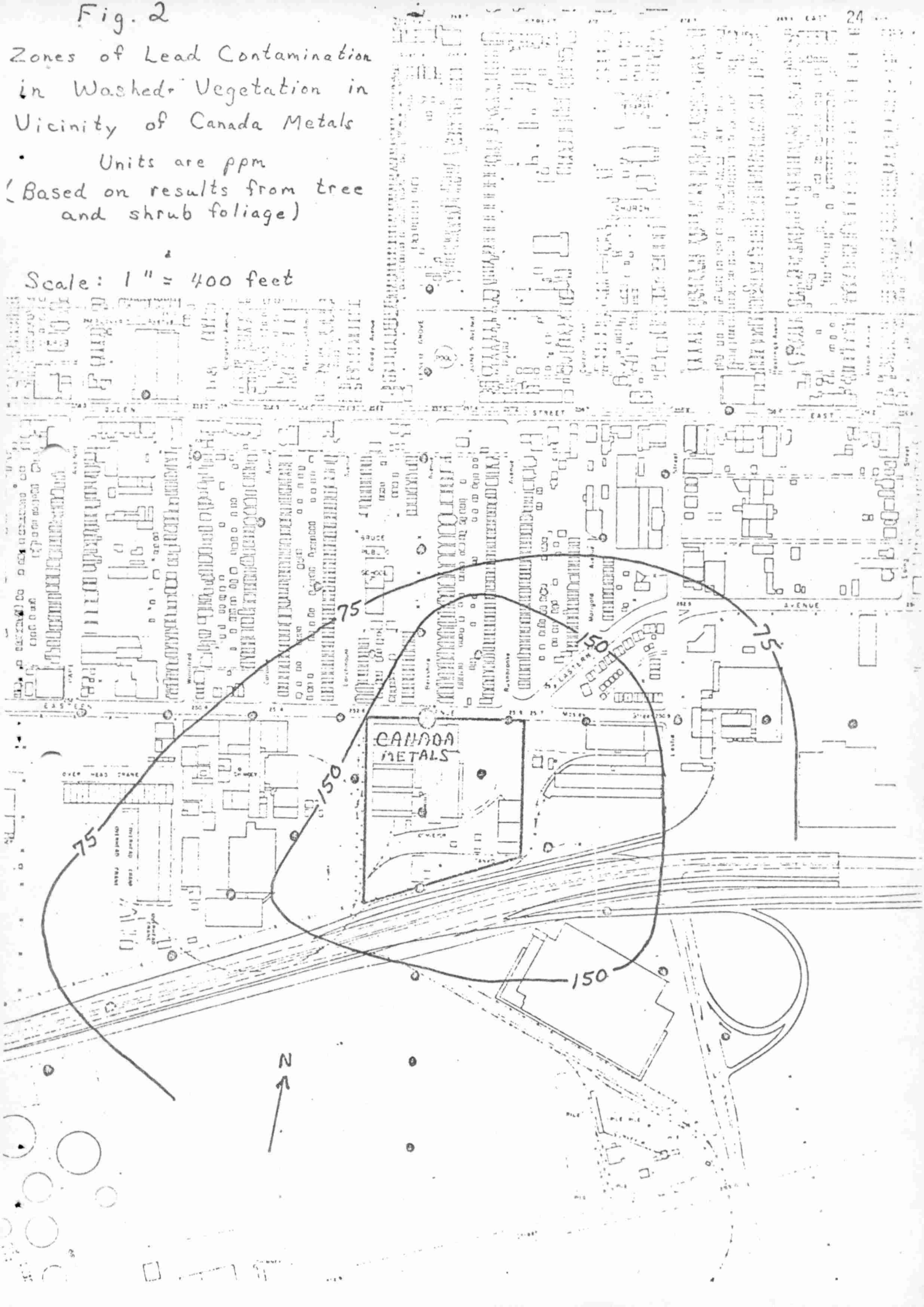


Fig. 3

Zones of Lead Contamination in Soil in Vicinity of Canada Metals (Based on 0-2" soil depth) Units are ppm.

Scale: 1" = 400 feet

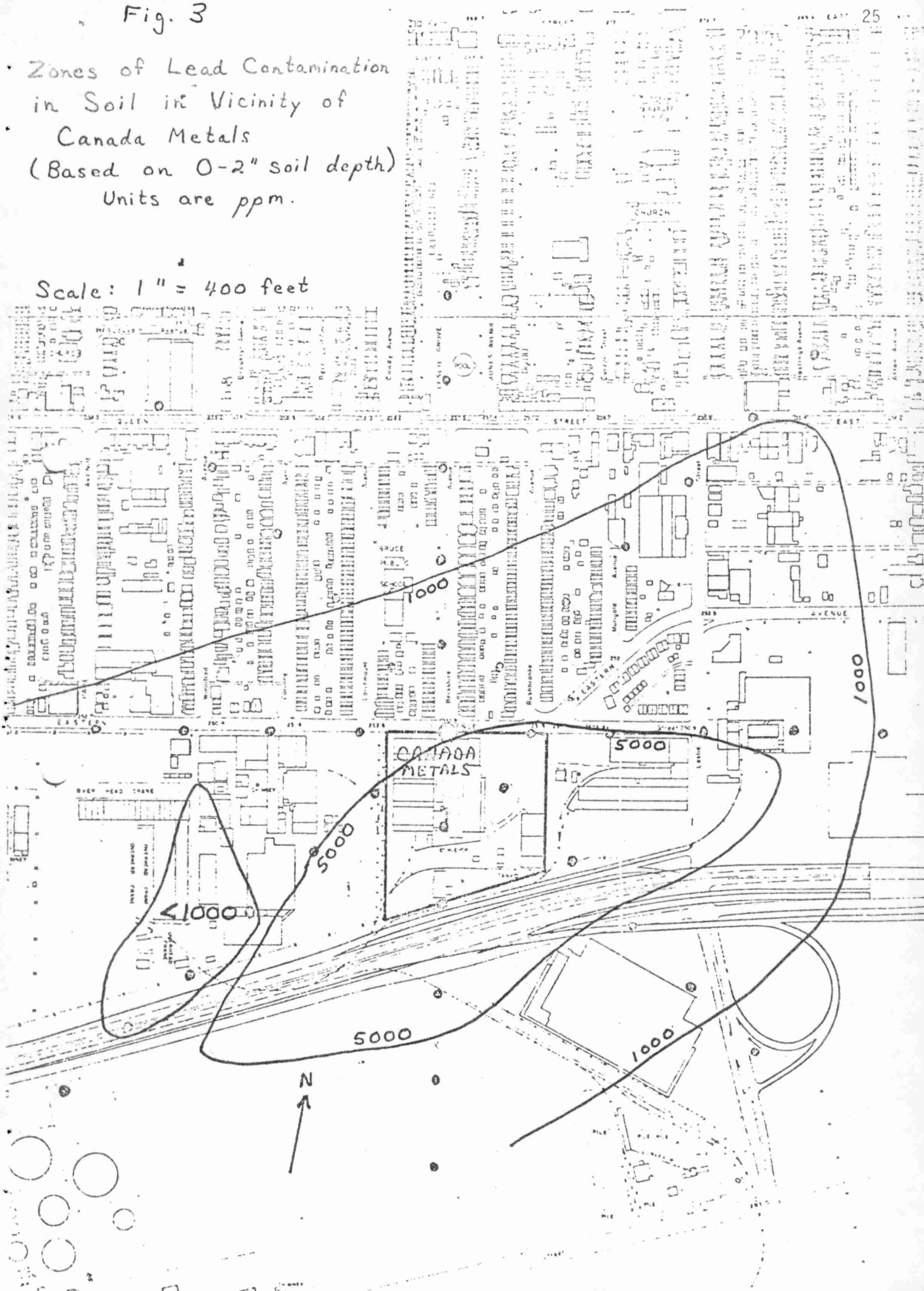
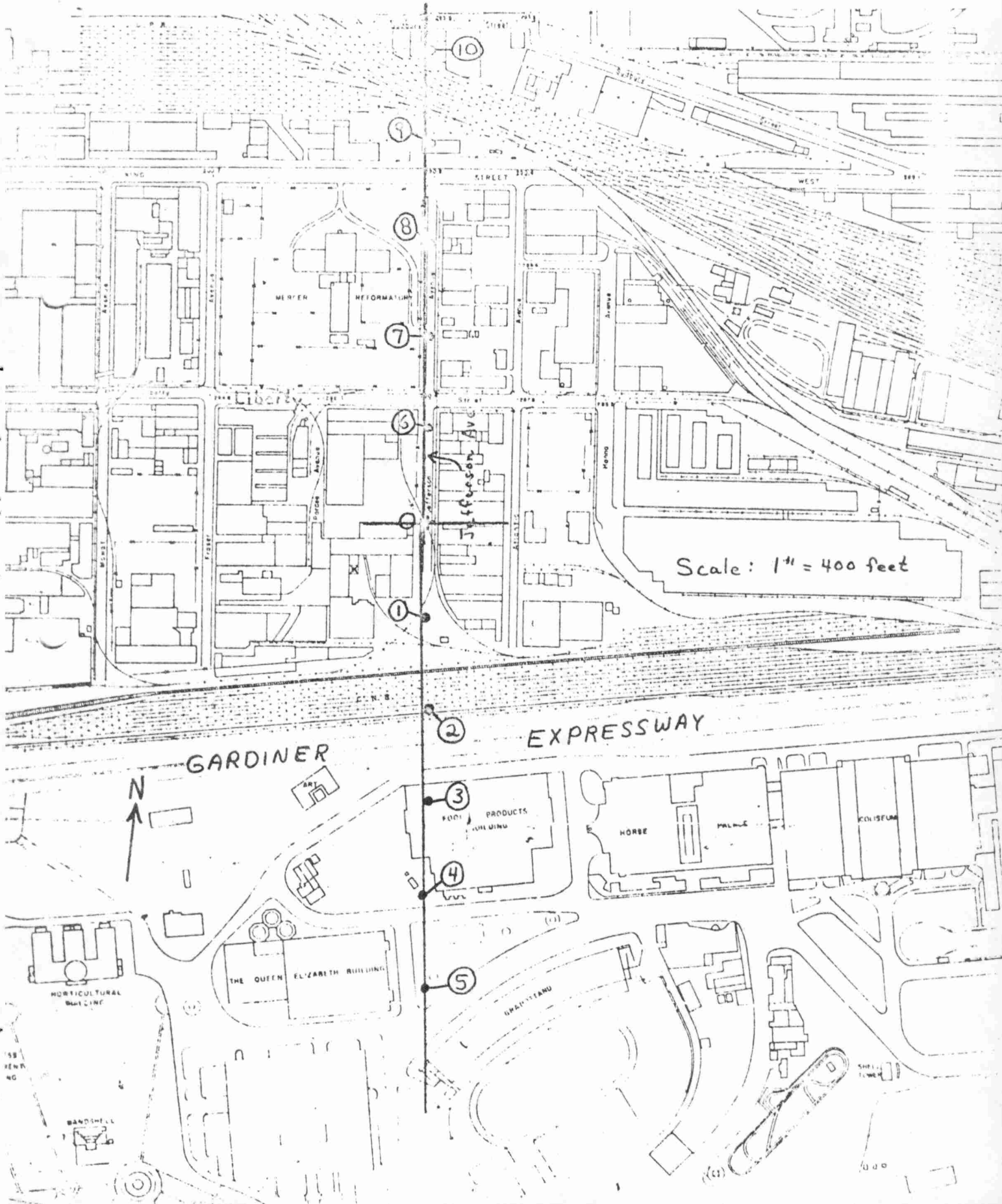


Fig. 4 Locations of Control Stations for Canada Metal Survey
November 2, 5, and 6, 1973



Complaint: Ext. _____

Int. _____

Surveillance XX

PHYTOTOXICOLOGY SECTION
AIR MANAGEMENT BRANCH

INVESTIGATION FINAL REPORT

Location TORONTO

Date(s) of Investigation November 19 and 20, 1973

Source Canada Metal Co. Ltd.

~~*Complaint*~~ Surveillance Study

Nature of Investigation Soil survey to determine depth of lead contamination

Description of Investigation

A soil sampling program was conducted in the residential areas in the vicinity of Canada Metals in order to achieve the following objectives:

(1) To determine the depth to which soil is contaminated in the vicinity of the company in the event that replacement is necessary, and

(2) To study the possibility of any lead contamination in the soil originating from lower geological materials.

Soil samples were collected on four directional lines (NE, N, NW, and W) radiating out from the source and intersecting adjacent residential areas. Sampling locations were located at 300-foot intervals along each radius as shown in Fig. 1. At each station, a soil sample was taken at a depth of 0-4", 4-8", 8-12", and at a depth of 12-16" where possible.

bservations and Results

The lead content of all soil samples is shown in Table 1. Using the value of 500 ppm as an indication of excessive lead levels in soil, contamination isopleths for each of three soil depths have been drawn on the attached map (Fig. 2). This map could be used as a basis for determining excavation depth in the event that soil replacement becomes necessary. Since sampling was restricted to the residential area within the W and NE radii, isopleths surrounding the plant could not be drawn.

It is apparent also from this map that lead is not originating from lower geological materials. The severity of contamination at lower soil depths was found to decrease with increasing distance from the plant.

Summary

Using the value of 500 ppm as an indicator of excessive lead levels in soil, a map showing contamination isopleths for three soil depths has been prepared. This map could be used as a basis for determining excavation depth in the event that soil replacement becomes necessary.

TABLE I

LEAD CONTENT OF SOILS COLLECTED IN THE VICINITY OF CANADA METAL , NOVEMBER 13, 1973

Station No.	Distance from Source	Lead content (ppm dry weight)			
		0-4"	4-8"	8-12"	12-16"
0	Source	5280	1150	328	-
1	300' E	5350	1080	978	-
6	300' NE	700	750	385	-
7	600' NE	630	253	380	513
8	900' NE	1410	268	168	-
9	1200' NE	1690	740	320	-
10	1500' NE	145	130	35	-
10 A	1800' NE	870	798	28	-
11	300' N	875	1900	395	348
12	600' N	405	623	188	170
13	900' N	798	330	130	60
14	1200' N	188	185	138	53
15	1500' N	148	53	30	28
16	300' NW	513	1080	1100	170
17 A	800' NNW	218	38	43	-
17	600' NW	583	403	168	90
18	900' NW	820	775	228	80
19	1200' NW	318	103	40	18
20	1500' NW	395	208	73	13
21	300' W	2280	743	80	68
22	600' W	1430	535	288	78
23	900' W	1380	1050	210	73
24	1200' W	1390	428	128	178
25	1500' W	1400	898	195	63

Fig. 1

Soil Sampling Locations in Vicinity of Canada Metal . November 19 and 20, 1973

① Station Location

Scale: 1" = 400 feet

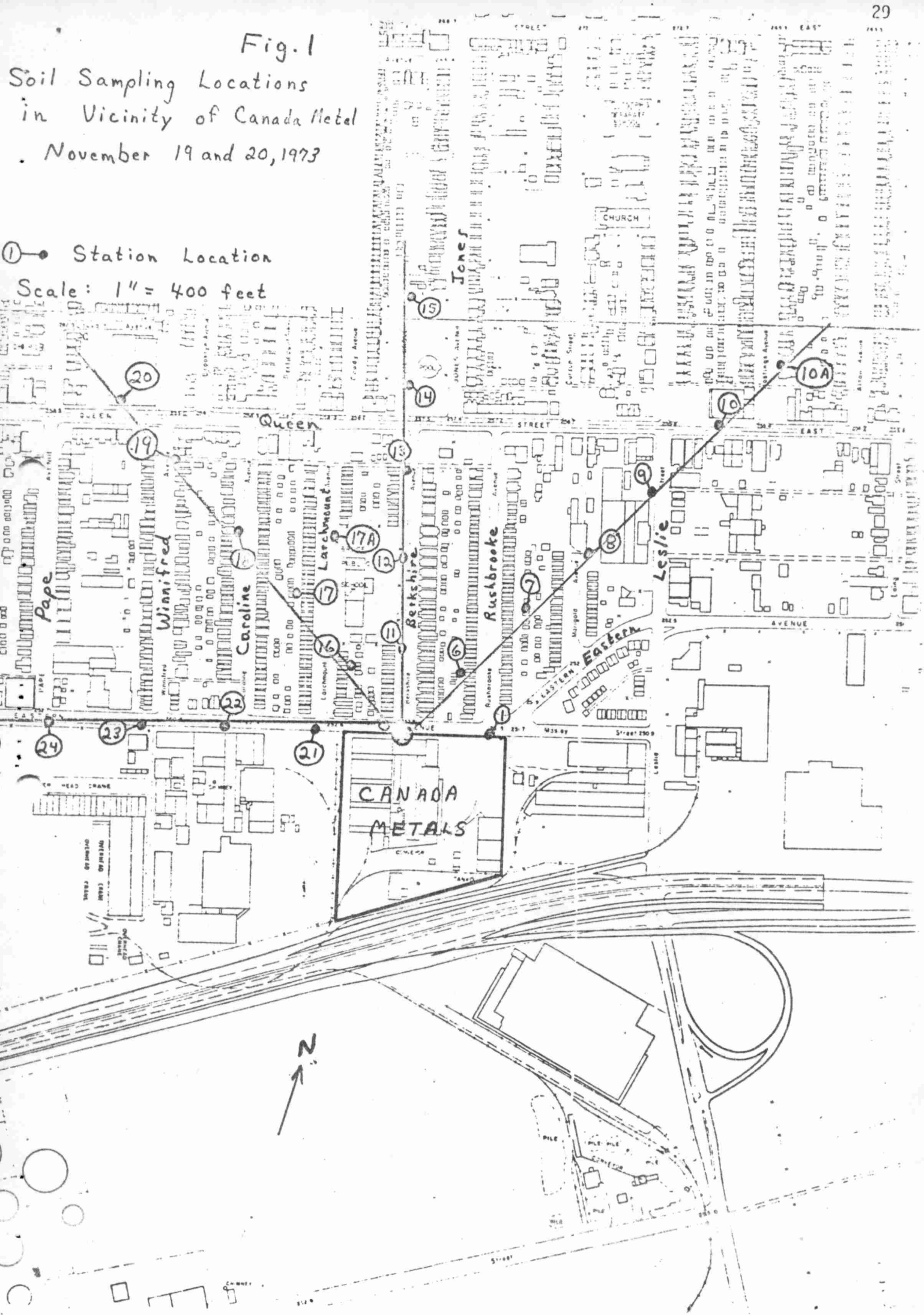
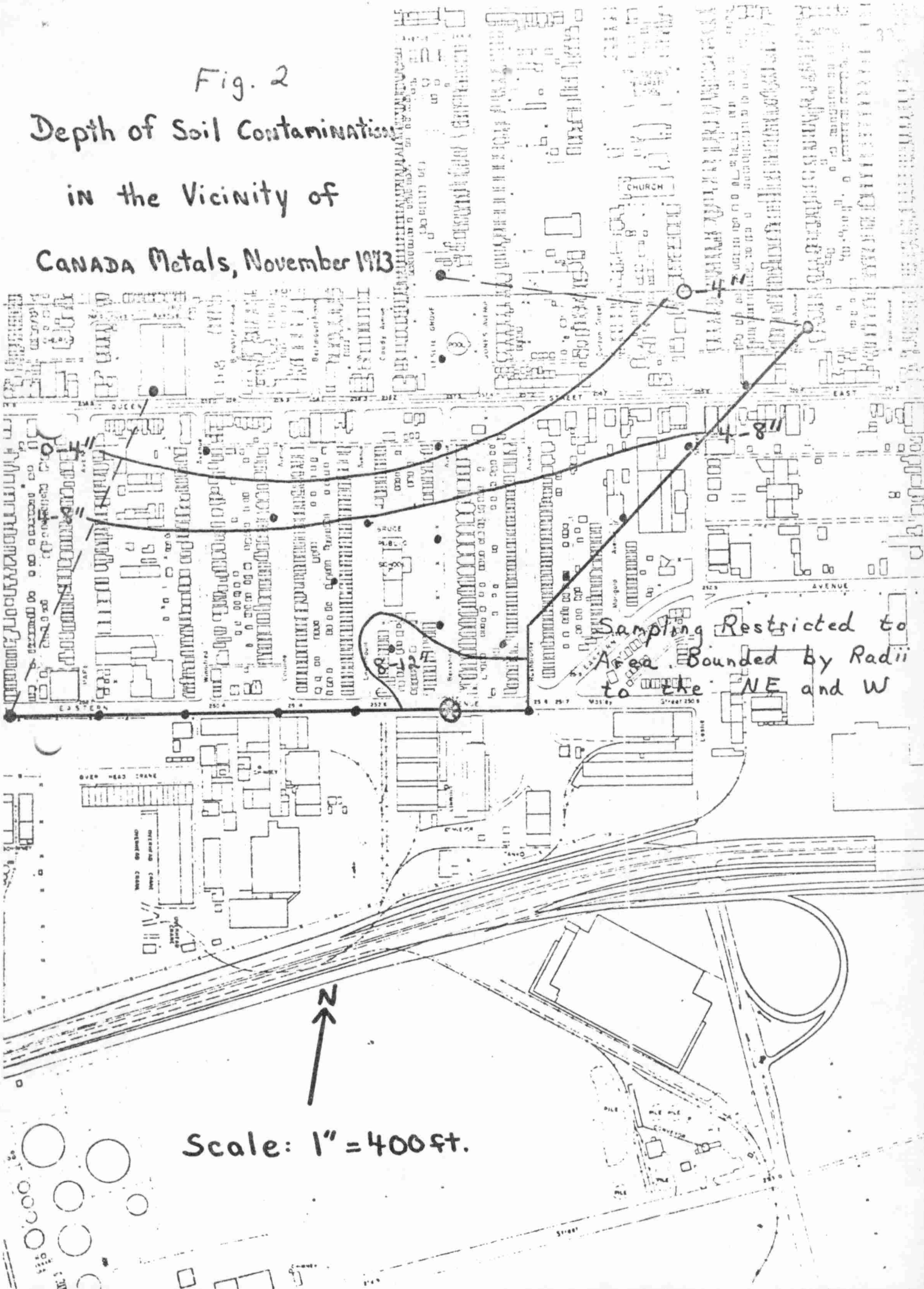


Fig. 2

Depth of Soil Contamination in the Vicinity of Canada Metals, November 1973



SECTION 5.3

PRELIMINARY MEDICAL REPORT ON BLOOD LEAD SAMPLING AT CANADA METAL

Dr. G.J. Stopps
Senior Medical Consultant
Environmental Health

December 7, 1973.

CANADA METAL COMPANY, LTD.

Investigation of the possible medical effects of lead contamination in the area surrounding Canada Metal Co. Ltd.

The information provided by the blood samples drawn from residents attending the Bruce Public School on October 15, 1973, is shown in tabular form below:

	AGE GROUPS			
	Less than 5	6 - 18	18+	TOTAL
Persons having 2 blood lead readings differing by less than 18 micrograms pb per 100 ml blood	73	422	136	631
Persons with 2 readings differing by more than 18 micrograms pb per 100 ml blood	5	14	2	21
Persons having only one blood lead result	3	14	7	24
Omitted from further consideration: 1 lead worker, 1 re-tested and 2 persons with unlisted addresses				4
			TOTAL	680

In those persons having a pair of readings differing by less than 18 micrograms those having values above 40 micrograms of lead per 100 ml were further studied. Due to the larger sample of the population who reside close to the plant, further sampling is being carried out to provide a more uniform geographical distribution. The results at this time must, therefore, be regarded as tentative but with this important proviso the following conclusions appear to be valid at this time.

In those residents living beyond 2000 feet from the centre of the plant inspection of the data suggests that the distribution of the blood lead values is more "normal" than in those residents living closer to the plant. At this time a more definitive statement is not possible but with further samples it is hoped that this will be possible early in the New Year.

In the age group less than six years old there was a moderately significant correlation of lead level with distance from the plant found ($0.05 \leq P < .10$).

In the age group 6-18 years no obvious trend of blood lead with distance is seen. Above the age of 18 the number of persons having blood leads greater than 40 (2 subjects) was insufficient to establish a trend.

In addition to the studies involving blood lead levels an epidemiological study involving a questionnaire, dust, water and paint samples is also under way but will not be completed for some weeks.

SECTION 6

ANALYSIS & SUMMARY

TORONTO REFINERS & SMELTERS LTD.

28 Bathurst Street

LIST OF FIGURES & TABLES SECTION 6

6. Analysis & Summary - Toronto Refiners & Smelters Limited

6.1 Process & Emissions

Identified emissions of contaminants from Toronto Refiners are listed on page 14 Section 7.1. Controlled lead emissions of about 0.8 lbs/hr average are expected. These emissions have passed through the main baghouse and therefore should be of a relatively small size.

Other unquantified emissions from fume which escapes the hoods and from materials handling operations are also undoubtedly present.

6.2 6.3 Levels of Lead in Air & Dustfall

Background Levels

Urban background levels in Toronto as indicated previously are of the order of 1.1-2.4 ug/m^3 of suspended lead particles and 0.03 - 0.08 tons/$mile^2$/30 days for lead in dustfall.

Toronto Refiners & Smelters is situated at about 1500 feet from the Gardiner Expressway (93,000 vpd) and faces onto Bathurst Street (14,700 vpd). In addition to the normal urban background levels based or figure 3 it would again be expected that a contribution of about 2 $\mu g/m^3$ could be present from the expressway at station 31051 and even less at station 31018. This latter station is located about 50' from Bathurst Street so that a contribution of about 2 $\mu g/m^3$ could occur under westerly winds which is the prevailing direction from the plant.

6.2 Suspended Lead Levels

From the above discussion it can be seen that levels in excess of 2-2.5 ug/m^3 at either station are indicative of a source of lead particulate other than automotive emissions.

Concentrations at the Bathurst Street Sampler never exceeded the present criterion of 15 ug/m^3 and only on an odd occasion exceeded the proposed criterion of 5 ug/m^3. The indication is therefore that contribution from the plant at this location is rarely greater than 3 ug/m^3.

The sampler located at the foot of Tecumseh Street is very close to the plant property line and suspended lead levels at this location have exceeded the present criteria on 2 days and the proposed criterion on 35 days. The implication is that larger particles are responsible for the high readings and these particles fall out before reaching the other sampler. This conclusion is supported by the lead in the dustfall readings which are excessive close to the plant but show a very rapid dropping off with distance. The use of particle sizing equipment on the sampler is scheduled and this should clarify the situation.

6.3 Lead in Dust-fall

The lead in dustfall readings adjacent to the Toronto Refiners & Smelters property are extremely high as shown in Fig. 1 and Table I for the period April - October 1973. The levels drop off rapidly in an exponential manner with distance

FIG. 1. DUSTFALL AT TORONTO REFINERS & SMELTERS (APRIL-OCTOBER 1975)

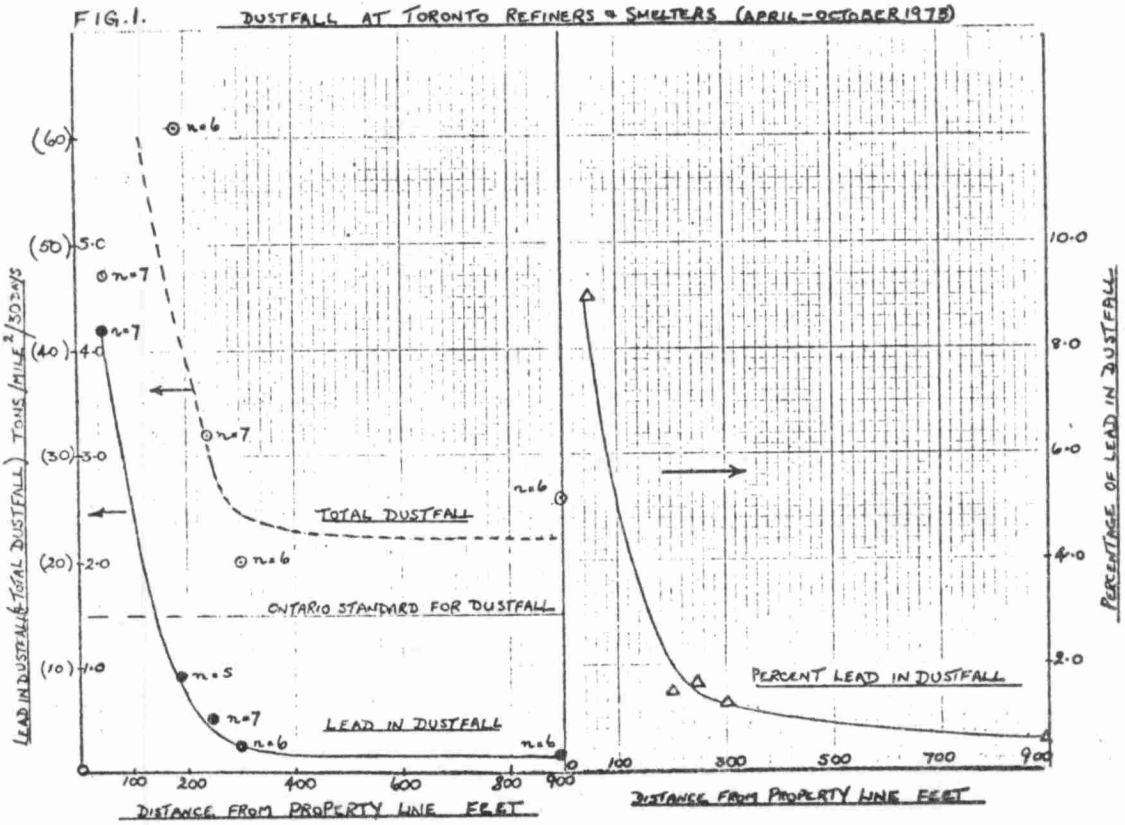


TABLE 1. VARIATION OF LEAD IN DUSTFALL AT TORONTO REFINERS & SMELTERS

Distance Feet	Lead in Dustfall Tons/mile^2/30d	Standard Deviation	Distance Meters	Lead in Dustfall Grams/m^2/30 D	Standard Deviation
50	4.24	0.51	15	1.49	0.18
200	0.92	0.22	61	0.32	0.08
250	0.50	0.18	76	0.18	0.06
300	0.26	0.06	92	0.09	0.02
900	0.15	0.09	275	0.05	0.03
1000	0.16	0.09	305	0.06	0.03

Data are based on 7 months monitoring

6.4 Particle Size Analysis

At present the particle sizing of hi-volume particulate catches has not been done by the Branch. An Andersen head is due to be installed in the near future to obtain data on particle sizes.

Data obtained by the University of Toronto at a similar distance to Station 31057 show a large fraction of particles in the 7u range much more so than found at Canada Metal. The locations of the two samplers makes any comparison highly speculative.

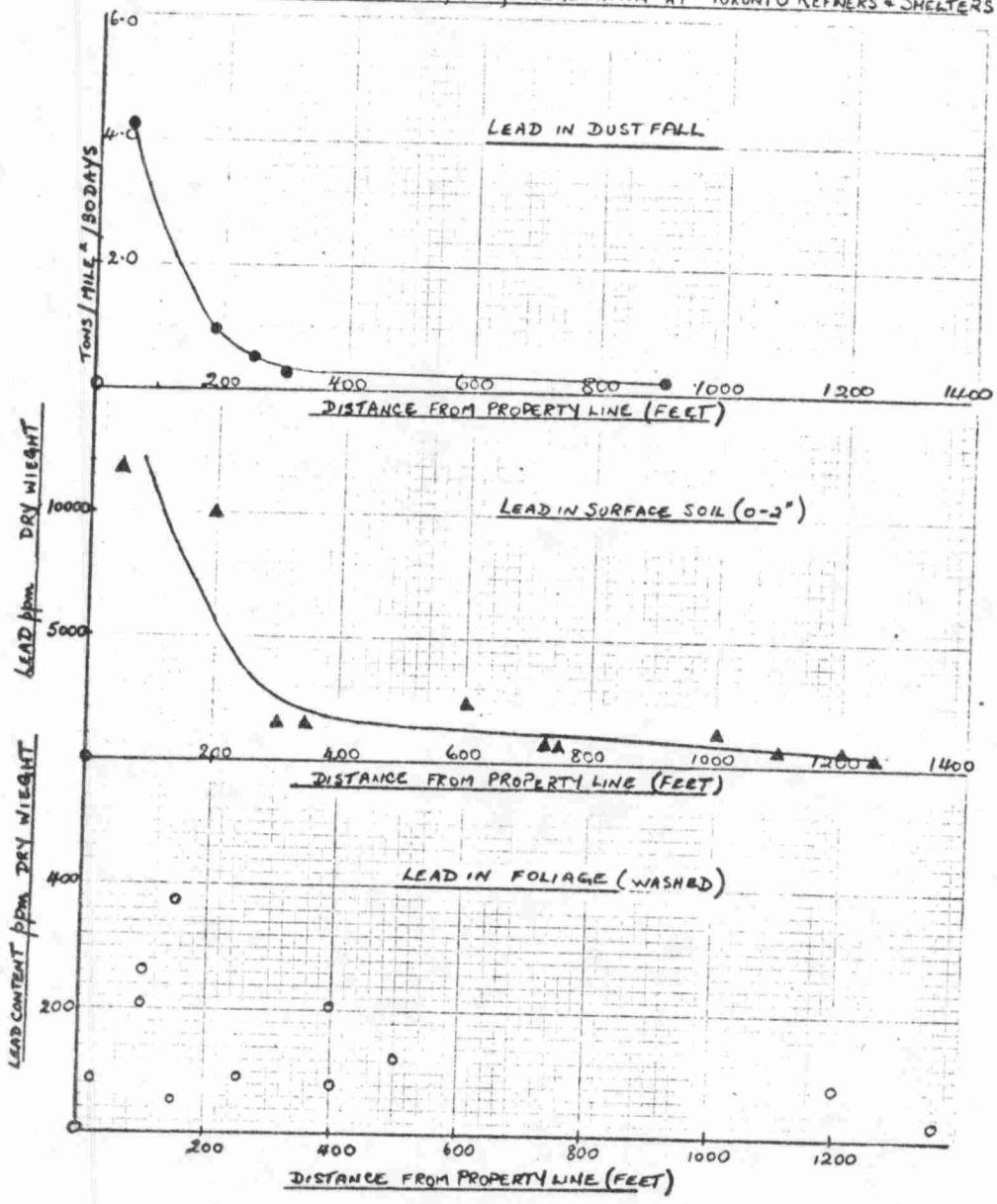
6.5 Lead Soil & Vegetation (Detailed Report Section 7.2)

Data obtained by the Phytotoxicology Section show very high levels of lead contamination in the soils and vegetation in the vicinity of Toronto Refiners.

The data indicate a rapid dropping off of the degree of soil contamination with distance and a marked difference between washed and not washed vegetation close in.

There was small area of markedly decreased contamination at the location of the battery crushing operation which did not operate and then was relocated and controlled.

FIG. 2 LEAD IN DUSTFALL, SOIL, & VEGETATION AT TORONTO REFINERS & SMELTERS



LEAD CONTENT OF DUST AND SOIL
COLLECTED IN THE VICINITY OF
TORONTO REFINERS AND SMELTERS, TORONTO

Station No.	Distance from Source	Lead Content of Dust (%)		Lead Content of Soil
		Street Surfaces	Other Surfaces	(0-2 inch layer)
1	200' E	1.10 (Bathurst)	7.72, 1.81	10 000
2	750' E	0.61 (Niagara)	1.07	813
3	1500' E	0.45 (Wellington)	0.82	1 375
4	2350' E	0.49 (Wellington)	-	590
5	600' NE	0.50 (Bathurst)	0.40	2 300
6	1000' NE	0.60 (Stewart)	0.54	1 325
7	1500' N	0.52 (Portland)	0.24	615
8	50' N	0.31 (Niagara)	2.23, 1.47	11 950
9	300' N	0.55 (Wellington)	0.97	1 400
10	850' N	0.46 (King)	-	1 300
11	1200' NW	0.38 (Adelaide)	0.24	225
12	350' NW	0.67 (Tecumseh)	1.47	1 475
13	725' NW	0.46 (Wellington)	0.67	850
14	1250' NW	0.31 (King)	-	238
15	1575' NW	0.41 (Niagara)	0.32	40
16	1100' W	0.37 (Walnut)	0.47	623
Controls	0.6 mi. N	0.42 (Bathurst)	0.48	-
	3.0 mi. N	0.78 (Bathurst)	0.43	-
	1.0 mi. NNW	0.34 (Dovercourt)	0.20	-
	2.5 mi. NE	-	-	320

LEAD CONTENT OF WASHED AILANTHUS FOLIAGE
COLLECTED IN 1972 AND 1973
AROUND TORONTO REFINERS AND SMELTERS,
IN PARTS PER MILLION, DRY WEIGHT

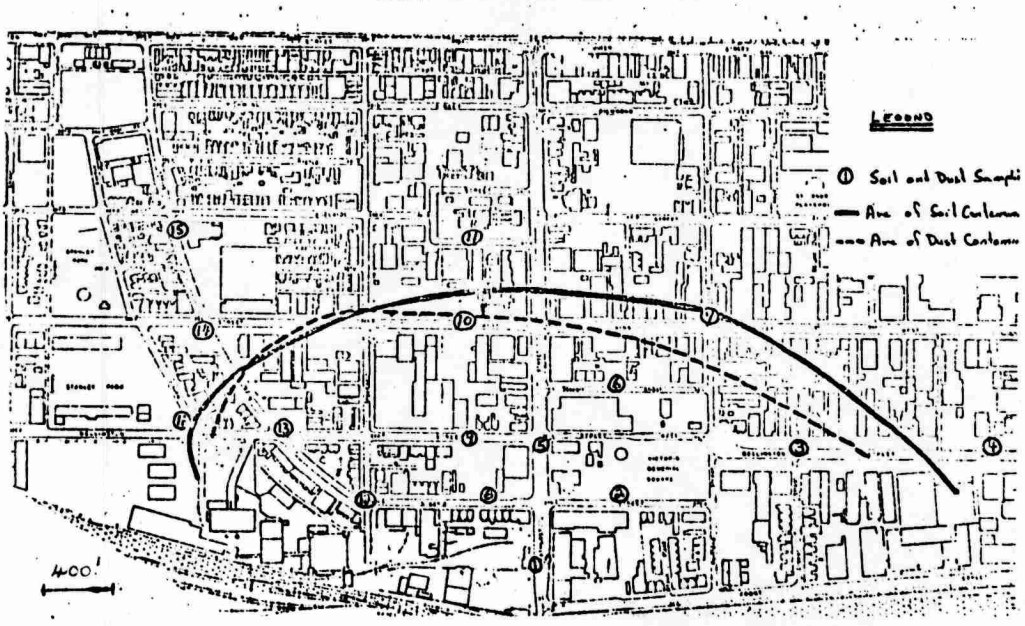
Station No.	Location-Distance & Direction from Smelter	Lead Content, PPM		
		July 24,1972	July 4,1973	Sept.19,1973
1	150' S	76	86	378
2	100' E	245	52	231
3	400' NE	96	22	74
4	1200' NE	45	24	81
5	500' NNE	71	48	128
6	20' N	2200[1]	120[1]	742[2]
7	150' N	280	60	47
8	250' N	50	22	89
9	100' W	80	220	288
10	400' W	62	110	288
11	1350' E	-	8	28
Control:	3 miles E	30	11	28

1 Backyard - 79 Niagara (20' N)
2 Frontyard - 79 Niagara (50' N)

AVERAGE LEAD LEVELS IN FRESH WASHED FRUIT AND VEGETABLES,
AND IN GARDEN SOIL
COLLECTED NEAR TORONTO REFINERS AND SMELTERS

Sample	A.M.G. Lead Content, PPM	
	Average	Range
Fruit	0.43	0.2 - 1.1
Lettuce	3.50	1.1 - 14.5
Leafy vegetables	1.24	0.4 - 1.9
Beans (whole pods)	0.77	0.6 - 1.0
Stem crops	1.00	0.4 - 1.7
Root crops	1.01	0.6 - 2.1
Garden soil 0-2 inches	672	198 - 1260
2-4 inches	681	288 - 1650

Fig. 4 Map Showing Location of Soil and Dust Sampling Stations in the Vicinity of TR & S and the Respective Areas of Lead Contamination, 1973

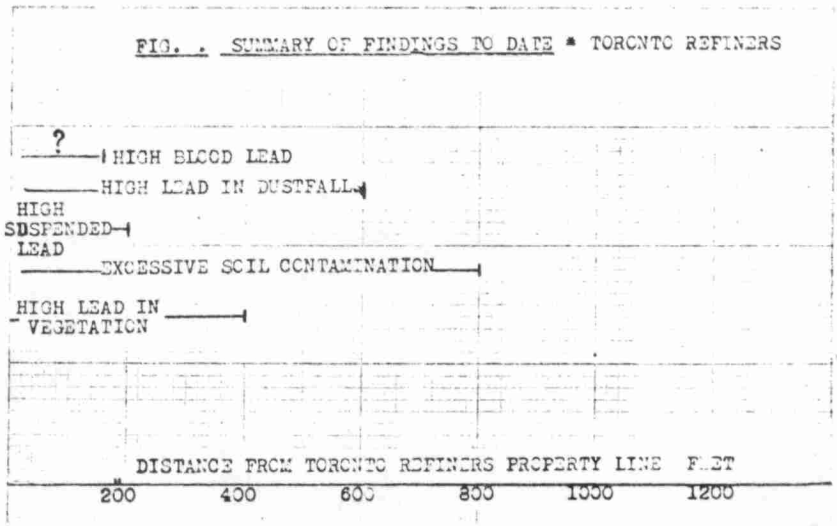


6.6 Conclusions Regarding Toronto Refiners

As at Canada Metals, studies into various aspects of lead pollution at Toronto Refiners & Smelters are still continuing. From the data available at present it is possible to draw preliminary conclusions:

1. Evidence exists that suggests that Toronto Refiners & Smelters is a source of excessive lead contamination at distances up to 500' from the property line.
2. The degree of control presently attained over fume emissions is high and there is no evidence of high suspended lead levels except very close-in which is likely due to larger particles from fugitive dust sources.
3. The quantity of settleable lead particles to account for the present high lead deposition rates close-in is very small so that an extreme degree of control over the fugitive dust sources will be necessary to have chance of meeting desirable levels of lead in air and dustfall soil & vegetation at distances of 150' and less.
4. As at Canada Metal evidence tends to discount re-entrainment as a major cause of high lead in air and dustfall (for reasons see Section 4.6).
5. Remaining problems at Toronto Refiners are due mainly to low level and fugitive dust emissions from the Company property.

6. Further studies are required to determine the sources of lead contamination and to rectify defects in the present data.



SECTION 7.1

ABATEMENT REPORT ON

TORONTO REFINERS & SMELTERS LIMITED

28 Bathurst Street
Toronto

BY: C.E. DUNCAN
Asst. Chief of Abatement.

INDEX TO SECTION 7.1

TORONTO REFINERS AND SMELTERS LIMITED,
28 BATHURST STREET,
TORONTO, ONTARIO

The Company operates a lead recovery plant using whole scrap batteries from automobiles and producing ingot lead and solder.

In Decmeber 1962, an exhaust gas stream was analysed and the sulphur dioxide gases found to be about 1,000 ppm. The analysis was performed at the Company's request.

On December 13, 1966, a smoke violation of by-law 601 was recorded and issued. No court action was taken.

On June 5, 1967, the Provincial Air Pollution Control Service was requested to investigate the installation and start up of a scrap aluminum smelter since the emissions from the operation were very visibly pronounced.

On April 10, 1968, the Air Pollution Control Service was advised by the Occupational Health Service, Department of Health, that a resident, near the plant, had developed lead poisoning symptoms, and that it was the opinion of the Department of Health that these symptoms were caused by the father working at the plant and unknowingly bringing home lead dust.

The Air Pollution Control Service of the Province of Ontario made an investigation on May 3, 1968, which revealed that there were rotary, reverberatory, blast furnaces all equipped with bag filters.

On May 31, 1968, a smoke violation was recorded and issued for emissions from the bag filters which were burnt out. No court action was taken.

cont'd....

In June 1968, the Service wrote to the Company and indicated that the Company must obtain a Certificate of Approval for its rotary furnace (lead recovery from the dross of tetraethyl lead manufacture) as required under section 7 of the Act.

On January 23, 1970, an inspection was made and a comprehensive report on the existing plant operations was filed.

On April 20, 1970, a local residents' committee forwarded a copy of a petition to Alderman June Marks, objecting to the operation at 28 Bathurst Street. The Air Management Branch acknowledged the petition and stated that it was performing an engineering survey to determine the sources of emissions and their control. On May 26, 1970, the City of Toronto wrote the Air Management Branch and requested that the Air Management Branch, the Building Department of the City, and the Ministry of Health, investigate the complaints and report to the Clerk on their findings. The Branch's comments on dust and vibration complaints was requested. On June 8, 1970, an internal memorandum requested that lead analysis be performed on samples taken from a sampling station. The Branch replied to the City Building Department that repairs would be made to the existing equipment and buildings to reduce emissions and vibrations.

On February 9, 1971, air quality results indicated that suspended lead levels were within regulations. The "hi-vol" sampling station was at the northeast corner of Niagara and Bathurst Streets.

Resulting from the Branch's observations of unsatisfactory control, the Company, in a letter on May 28, 1971, confirmed that it had discontinued the practice of torch cutting of batteries on the northside of the in-plant rail tracks, sealed holes in the building on the eastside of its Niagara Street entrance driveway, and would continue to dampen its yard areas.

cont'd.....

A technical report by the Approvals Section of the Air Management Branch on May 19, 1972, indicated that emissions of lead and SO_2 from the plant were estimated to be in violation of the regulations.

On June 30, 1972, the Company requested advice on the suitability of relocating its operations to either Mimico or a location near Saulter and Commissioners Streets.

On June 22, 1972, the Branch initiated a survey of plant operations as authorized under section 83 of the Act.

On July 18, 1972, the Branch investigated the complaint of dust emissions from the battery top crusher. Analysis of dust taken from residents' premises indicated high lead content and on July 19, 1972, a Stop Order was issued for this operation. This crusher had been in operation since 1968 at this location on the property.

The first vegetation and soil samples were taken by the Phytotoxicology Section on July 24 and 26, 1972. Results revealed high lead levels in vegetation and soil but no vegetation damage. Since the section 83 report indicated high arsenic emissions which resulted in impingement concentrations in excess of 75 ug/m^3 which is a standard used by the Branch, it was requested that arsenic analysis in soil and vegetation also be performed. The report also revealed high lead emissions and the Branch requested a medical opinion.

The draft of a section 83 report was completed and on September 8, 1972, the report was discussed with the Company. It was agreed that SO_2 and lead emissions from the main stack were in violation. There were disagreements as to whether acid odours from the guillotine area (battery cutting operation) and the lead emissions from the kettles were in violation of the regulations.

cont'd....

On September 14, 1972, the company indicated that it had hired a consultant to study the report and requested a meeting after the consultants had completed their study. The Branch agreed to this arrangement.

A request for "background lead level" from the Gardiner Expressway was made to the Phytotoxicology Section on September 15, 1972.

On September 20, 1972, at the company's request, the Branch advised the company that a main stack height of 250 ft. would be required. Also the company implied that it had asked a consultant to perform stack testing.

The Phytotoxicology Section replied that the "background lead level" caused by the Gardiner traffic was one fiftieth of that found in the plant vicinity. The reply was made on September 28, 1972.

At a meeting with the company on October 4, 1972, it was agreed to:

1. Test for acid mist from the guillotine area.
2. To forego the construction of a building for scrap storage pile, providing the piles were maintained in a damp condition and covered with tarpaulins.
3. To continue watering and oiling open yard areas.
4. To stack test all emission points for lead, arsenic and cadmium.
5. To make modifications to control emissions from slag tap at the reverberatory and blast furnaces.

On October 13, 1972, the company confirmed its abatement activities in a letter.

On October 19, 1972, concerned residents were informed of the high lead levels in soil and vegetation samples from their property on July 24, 1972. Each finding was expressed to its respective resident that the levels were higher than those found in other areas. However, vegetables, if properly washed, were safe for consumption.

cont'd.....

On October 19, 1972, the Company made a formal submission under section 10 of the Act.

A prime complainant in the area demanded and received copies of laboratory analysis of dust and hi-vol samples taken in the area. Emission rates of particulate matter, lead, SO_2, NOX, phosphorous oxides, and arsenic were also given.

On November 3, 1972, samples of accumulations were taken from the roof of a neighbouring Company and were later found to contain elevated lead levels.

On November 6, 1972, Mr. Lachocki (complainant) was advised that all medical findings related to his family had been made known to him and nothing was being withheld.

On November 15, 1972, the Company was denied permission to test a new battery top separator operation, since a Certificate of Approval and relocation of the operation would be required prior to such a test.

On January 12, 1973, the Environmental Health Service Branch stated that there were no recent lead problems associated with the plant employees.

On January 16, 1973, the Company received approval of their Abatement Program.

On January 17, 1973, an internal memorandum summarized medical evidence to date. Elevated lead levels in blood were mentioned.

On February 6, 1973, samples of loose accumulations were taken from the streets around the plant and submitted to the laboratory for lead analysis.

All through the above period, discussions were held with the Company to review the results of the stack testing. On February 6, 1973, the Approvals Section confirmed that 0.77 lb of lead/hr. were emitted and that their stack design should be based on 375 lbs of SO_2/hr.

cont'd.....

More medical findings were reported to the Director on January 30, 1973.

A Certificate of Approval was issued on February 9, 1973 for the bag filter control of the slag taps and lead wells of the blast and reverberatory furnaces.

On February 26, 1973, the Company submitted an application for a proposed battery top crusher.

On March 1, 1973, snow samples were collected from a complainant's premises and submitted to the laboratory for lead analysis. Results were received on March 7, 1973 and indicated a marked reduction since the termination of the previous battery top crusher operation.

On March 7, 1973, the Company agreed to implement additional housekeeping measures, to sweep in-plant roads, wash tires, remove scrap piles and cover other piles.

On March 26, 1973, analysis of dust samples collected from the Regina's premises indicated 4.5% lead content.

In an internal memorandum, concern was expressed that surface dust containing lead could be inhaled or ingested by the residents and the opinion was also expressed that in the absence of continuing deposition, lead content on vegetation and off-property surfaces will decrease.

On April 3, 1973, a Certificate of Approval was issued on the proposed battery top crusher.

On April 10, 1973, the Company was placed on the API list for high SO_2 emissions.

In conjunction with the blood sampling program in the area, the Phytotoxicology Section performed soil surveys in the off-property area on March 13, 1973. Results indicated the extent of the contaminated area.

On April 12, 1973, the Branch inspected the new battery top crusher. Further changes were required as a result of the trial operation.

cont'd.....

An inspection of area zoning revealed that the plant and the residences were legally non-conforming (memo April 30/73.)

On May 1, 1973, the Company indicated to the Branch that the building permit for the proposed 175 ft. stack would not be issued (by the Toronto Building Department).

On May 3, 1973, Mr. Lachocki was advised of the results of the March 1, 1973 snow samples taken from his premises. The results indicated a marked reduction of lead content in dust from 50% to 2.5%, which was still higher than some parts of the City.

On April 25, 1973, various community associations in the area wrote to the Branch and requested that the building permit for the proposed 175 ft. stack not be issued.

On May 29, 1973, the Air Management Branch met with the Company to present an independent report prepared by non-involved Branch personnel. After discussion, the report was left with the Company for further study. During this meeting, the Company raised the question of the required height of the main stack, assuming that a proposed 360' apartment-hotel complex was erected within 1000 ft. They were advised that the stack height requirement would increase from 175' to 375'.

On June 1, 1973, a Certificate of Approval for the new battery top crusher was issued. After a thorough inspection on June 11, 1973, it was considered that the battery top crusher could be operated within regulations and it was recommended to the Director to lift the Stop Order. On July 6, 1973, this Order was revoked. Total down time was 352 days.

On July 11, 12 and 13, 1973, more dust samples were taken from off-property.

On July 20, 1973, the Air Management Branch met with the Company and the Medical Officer of Health. The Company agreed to construct a building to house raw material storage and the Air Management Branch concurred with the proposal. The Air Management Branch was represented to assist the Medical Officer in developing a program to satisfy his abatement order made under The Public Health Act.

cont'd.....

On July 13, 1973, the Ministry of Health released blood testing results which indicated that some of the residents had elevated lead levels.

On July 24, 1973, as a result of recent inspections and observations, sulphurous odours were considered to be coming from the main stack and would be controlled when the 175' stack was constructed. All other abatement steps had been taken or were in operation (paving, sweeping, road washing, and oiling).

On July 4, 1973, the Phytotoxicology Section performed another soil and vegetation survey. Results indicated that close to the plant there was a marked reduction of lead in foliage but the lead content in soil remained unchanged.

On August 24, 1973, the latest air quality monitoring results were forwarded to the Company.

On July 20, 1973, the City Clerk wrote the Premier of Ontario advising that the Council had instructed the city solicitor to apply to the Supreme Court of Ontario for an abatement order under the Public Health Act; had requested that the Province take no further unilaterial action and had requested that the Provincial Laboratories provide the Medical Officer of Health with all outstanding results of blood samples submitted.

This request was answered by the Premier on August 17, 1973, stating that the blood results had been given to the Medical Officer of Health and thatunilateral action could not be avoided under the circumstances.

cont'd.....

On September 10, 1973, the Branch confirmed that it had no misgivings of the Company relocating to a location on Commissioners Street providing that Certificate of Approval was issued before construction.

Air quality results were released on September 4, 1973 to the Environmental Law Association.

The Building Department received an application for a building permit to construct a building for the storage of scrap piles (September 17/73).

On July 27, 1973, the Branch released the Phytotoxicology Section's report of July 23, 1973, on soil and vegetation surveys to the Company.

A meeting to exchange knowledge among University of Toronto, Air Management Branch, Ministry of Health and Department of Health representatives was held on October 19, 1973. The University of Toronto blood sampling program showed no significant change in blood lead levels in the past year in the vicinity of Toronto Refiners and Smelters Ltd.

On October 4, 1973, a report on the results of soil and vegetation samples taken in the area on July 30, 1973 was issued. Results indicated that most samples were below federal standards for the maximum accpetable limit for lead in fresh fruit (7 parts per million) and in fresh vegetables (2ppm). These standards were established by the Health Protection Branch of the federal government.

On October 19, 1973, we received a demand that an order be issued on the Company to halt all plant operations. Since the matter of Stop Orders was being debated in court, the Branch declined to comment on the subject and suggested that any medical opinion be forwarded immediately.

cont'd.....

On November 13, 1973, the Branch forwarded to the Company its latest Hi-vol monitoring results which indicated some high lead levels and requested the company to review its operations on the days in question.

On November 14, 1973, the Approvals Section confirmed that a 175' stack will control SO_2 and lead emissions from the furnaces and kettles in accordance with regulations.

At a city Board of Health meeting on November 14, 1973, the University of Toronto, Environmental Sciences and Engineering Section, tabled reports of their investigations around Canada Metals and Toronto Refiners & Smelters. They concluded that there was no indication that the Air Management Branch cleanup measures had any effect on the "severe ongoing lead contamination" found in the vicinity of Toronto Refiners and Smelters. They further concluded that for both companies, the plant operations contributed significantly to the high lead levels found in the environment.

The Air Management Branch met with the authors of the University of Toronto reports on November 27, 1973, to review their data.

cont'd...

SUMMARY

Since 1970 to the present time, the Company has taken the following corrective action:

a) The aluminum dross operation was discontinued.

b) All in-plant vehicular traffic routes have been paved with hard surface.

c) All traffic routes are swept continuously.

d) Ready use raw material storage piles are covered with large plastic sheets and in-plant material handling has been containerized.

e) Storage piles are watered or oiled before being worked.

f) Truck tires are being water washed before the vehicle leaves the premises.

g) The battery top crusher has been relocated and controlled with an approved settling chamber, a bag filter and stack.

h) Exhaust fume emissions from the slag tap and lead well, at each of the blast and reverberatory furnaces, have been controlled by the installation of exhaust hoods and ducts to direct the fumes to the main bag filter.

i) Emissions from three, 40 ton capacity kettles previously fitted with exhaust hoods have been directed to the main bag filter during filling, refining, alloying and pouring.

j) The remaining five smaller kettles have been ducted to the main bag filter.

k) The rotary furnace has been shutdown for approximately one year. The company acknowledges that a Certificate of Approval is required if it is ever to be re-started.

cont'd....

The only item still outstanding on the Program Approval is the construction of a 175 ft. chimney stack to control emissions from the main bag filter. Completion of this item is dependent on the company receiving a building permit from the city. At this time it is unclear when this permit will be issued.

A further requirement of the Medical Officer of Health that the company construct a building to enclose long term stockpiles of lead bearing raw materials has been held up for the same reason.

January 9, 1974
RMRH/ng

ANNUAL EMISSIONS

TORONTO REFINERS & SMELTERS LTD.

As an indication of the longer term situation the following are the estimated yearly emissions in pounds per year.

Compound	As of Nov.1973	Completion of Order
Lead	21420	21420
Silver	-	-
Cadmium Oxide	83	83
Arsenic	61	61

TORONTO REFINERS & SMELTERS

Calculated Emission Data

These data are, with the exception of the furnaces, short term values resulting from batch operations.

Contaminant	Pounds per Hour Emitted		
	January 1968	November 15, 1973	At Completion of Program Approval
Lead & Its Compounds			
Blast Furnace	2.6	1.0	1.0
Reverb Furnace	2.3	0.8	0.8
Melting & Alloying 3-40 Ton, 1-5 Ton, 1-20 Ton, 3-1.25 Ton	5.0	1.3	1.3
Rotary Furnace	0.5	Shutdown	
Battery Top Crusher	emissions not calculable	0.1	0.1
TOTAL LEAD	10.4	3.2	3.2
Silver	negligible	negligible	negligible
Cadmium Oxide	3.0	0.3	0.3
Arsenic	108.7	2.2	2.2
Sulphur Dioxide			
Blast Furnace	94	94	94
Reverb Furnace	106	106	106
40 ton kettles	10 lb/hr.	10 lb/hr.	10 lb/hr.
TOTAL SO_2	210	210	210

STACK TESTING DATA ON MAIN STACK AT TORONTO REFINERS & SMELTERS LTD.

Conducted by James F. McLaren Ltd., November, 1972

Contaminant	Emission Rate (average over 3 tests)	Maximum Emission Rate (lb/hr)
Particulate	1.3	2.1
Lead	0.68	1.1
Sulphur dioxide	297.	375.
Arsenic *	0.02	0.025

* Based on data in McLaren's report expressing Arsenic collected on filter paper as % of total particulate collected

Ontario

MINISTRY OF THE ENVIRONMENT

PROGRAM APPROVAL

TO: Toronto Refiners & Smelters Limited,
28 Bathurst Street,
Toronto, Ontario.

Attention: Mr. M.B. Kaufman

TAKE NOTICE THAT in accordance with the provisions of The Environmental Protection Act, 1971 the program as submitted by you and set out below is hereby approved.

1. The Company will take the necessary steps by the dates hereafter set out, to install and place in continuing operation, equipment and materials so that thereafter the emissions of suspended particulate matter, lead and its compounds, arsenic and its compounds, sulphur oxides expressed as sulphur dioxide and oxides of nitrogen from the following, will not, in the aggregate, be in contravention of The Environmental Protection Act, 1971 or regulations made thereunder:

a)	Blast Furnace----------	May 31, 1973
b)	Reverberatory Furnace----------	May 31, 1973
c)	Rotary Furnace----------	July 31, 1973
d)	Three, forty ton kettles--------	May 31, 1973
e)	One, twenty ton kettle----------	July 31, 1973
f)	One, five ton kettle----------	July 31, 1973
g)	Three, twenty five hundred pound kettles----------	July 31, 1973

2. The Company will take the necessary steps by June 1, 1973 to install and place in continuing operation, equipment and materials, so that thereafter the emission of suspended particulate matter and lead and its compounds from open storage piles of lead plates, lead oxide, lead sulphate and dross will not, in the aggregate, be in contravention of the Act or regulations made thereunder.

Cont'd....

3. The Company will take such further steps as are necessary so that by July 31, 1973, and thereafter, the emissions of lead and its compounds and suspended particulate matter from all sources on the property will not, in the aggregate, be in contravention of the Act or regulations made thereunder.

4. Concurrently with compliance with the subject program, and an improvement in housekeeping practices: the Company, in co-operation with the Air Management Branch of the Ministry of the Environment, will undertake an evaluation of the emission of occurs from its property and will submit a program for approval by June 30, 1973.

5. Pending implementation of this program, the Company will take all steps necessary to minimize air pollution.

6. All parts of this program refer to operations and equipment of the Company on its property at 28 Bathurst Street in the Municipality of Metropolitan Toronto.

T.W. Cross

for C.J. Macfarlane, Director,
Air Management Branch.

Dated at Toronto this 16th

day of January, 1973.

Back-up data for Table on

"Calculated Emission Data"

TORONTO REFINERS & SMELTERS LTD.
TORONTO, ONTARIO

BLAST FURNACE

In January, 1968, lead compound emissions were:-

Compilation of Air Pollution Emission Factor = 2.3 lb. of particulate per ton of lead produced (controlled furnace).

$$\frac{2.3 \text{ lb.}}{\text{ton}} \times \frac{25 \text{ tons}}{\text{day}} \times \frac{1 \text{ day}}{24 \text{ hr.}} \times \frac{70\% \text{ lead}}{\text{particulate}} = 1.7 \text{ lb. of lead/hr}$$

Total lead emissions from the lead taps of the blast reverb furnaces are:-(E.P.A. emission factor for lead is 0.8 lb/ton).

$$\left(\frac{25 \text{ tons}}{\text{day-blast}} + \frac{30 \text{ tons}}{\text{day reverb}} \right) \times \frac{1 \text{ day}}{24 \text{ hr.}} \times \frac{0.8 \text{ lb.}}{\text{ton}} = \frac{1.83 \text{ lb.}}{\text{hr}}$$

1/2 of lead tap emissions = 0.9 lb/hr. are considered to be from the blast furnace.

total lead emission from blast furnace = 1.7 + 0.9
= 2.6 lb/hr.

After November 15, 1973 (after control) this was:-

$$\frac{13 \text{ lb/hr. (Can.Metal.)}}{50 \text{ ton capacity(Can.Met.)}} \times 35 \text{ ton capacity TRS} = 1.0 \text{ lb/hr.}$$

REVERB FURNACE

In June, 1968, the reverb furnace emissions were:

$$\frac{2.3 \text{ lb}}{\text{ton}} \times \frac{30 \text{ tons}}{\text{day}} \times \frac{1 \text{ day}}{24 \text{ hr.}} \times \frac{70\% \text{ lead}}{\text{particulate}} = 1.4 \text{ lb/hr.}$$

lead tap = 0.9 lb/hr

TOTAL = 2.3 lb/hr

After control (November 15,1973), emissions are

$$\frac{1.4 \text{ lb/hr - reverb}}{1.7 \text{ lb/hr - blast}} \times 1.0 \text{ lb/hr.blast} = 0.8 \text{ lb/hr - reverb}$$

cont'd.....

ROTARY FURNACE

In June, 1968 , emissions were: (assume 98% efficiency for baghouse) (AP - 42 emission factor is 70 lb/ton.)

$$\frac{9 \text{ tons produced}}{24 \text{ hr.}} \times \frac{70 \text{ lb of lead emission}}{\text{ton produced}} \times 0.02 = 5 \text{ lb/hr.}$$

The rotary furnace is now shutdown .

MELTING & ALLOYING KETTLES

The E.P.A. emission factor of 0.8 lb/ton was used to calculate the emissions from these sources. It takes approximately 24 hours to heat, melt, refine and pour lead in the 20 and 40 ton kettles and 16 hours in the 1.25 and 5 ton kettles. Therefore, in 1968, when the emissions were uncontrolled, the emission rate was:

1) Three 1.25 tons kettles

$$\frac{3.75}{16 \text{ hrs.}} \times \frac{0.8 \text{ lb.}}{\text{ton}} = 0.187 \text{ lb/hr}$$

2) 5 and 20 ton kettles

$$\left[\frac{5}{16} + \frac{20}{24}\right] \times \frac{0.8 \text{ lb}}{\text{ton}} = 0.88 \text{ lb/hr.}$$

3) 3 - 40 ton kettles

$$\frac{120 \text{ tons}}{24 \text{ hrs.}} \times \frac{0.8 \text{ lb.}}{\text{ton}} = 4.0 \text{ lb/hr.}$$

TOTAL = 5.0 lb/hr.

All kettles are now ducted to the baghouse and the typical production rate at Toronto Refiners is approximately identical to that of Canada Metal Co.Ltd. Therefore, it was estimated that the emission rate of lead from both operations would be identical, i.e. 1.3 lb/hr.

cont'd....

BATTERY TOP CRUSHER

In June 1968, emissions were not calculable. However, in the Certificate of Approval (after control) the emissions are:

$$.002 \frac{gr.}{ft.^3} \times 4000 \frac{ft.^3}{min} \times \frac{60 \text{ min.}}{hr.} \times \frac{lb.}{7000 \text{ gr.}} = 0.1 \text{ lb/hr.}$$

CADMIUM OXIDE EMISSIONS

In January 1968, emissions may have been going directly to atmosphere. These emission rates were:

$$\frac{4.2 \text{ lb/hr.- Can.Met}}{70 \text{ lb. - charge Can.Met.}} \times 80 \text{ lb. - charge TRS} = 3.0 \text{ lb.of Cadmium oxide/hr at TRS}$$

After control (November 15, 1973) alloying emissions go to bagfilter at all times, Cadmium Oxide emissions are reduced to 10% of former value. Therefore:

$$0.01 \times 3.0 = 0.3 \text{ lb/hr.}$$

ARSENIC

The Company provided mass balance data which showed that for 100 lb. of $As_2 O_3$ added to a kettle 35 lb. of arsenic are alloyed in the melt and 19.8 lb. are emitted to the atmosphere. The alloying operation takes 11 hours and the final arsenic composition in the alloy is 2%. Therefore the emission rate is:

$$Q = \frac{40 \text{ tons}}{11 \text{ hrs.}} \times \frac{2000 \text{ lb.}}{\text{ton}} \times \frac{2}{100} \times \frac{100}{35} \times \frac{197.8}{149.8} \times \frac{19.8}{100}$$

$$= 108.7 \text{ lb/hr.}$$

After November 15, 1973 with control (98% collection efficiency) emissions are = 0.02 x 108.7 = 2.2 lb/hr.

cont'd....

SULPHUR DIOXIDE

From data provided in the E.P.A. manual A.P. 42 the emission factors for SO_2 for Blast & Reverb furnaces are 90 and 85 lb./ton respectively.

The capacity of the blast and reverb furnaces are 25 and 30 tons per day respectively. Therefore, the SO_2 emission rates are:

for the Blast furnace

$$\frac{25 \text{ tons}}{\text{day}} \times \frac{90 \text{ lb.}}{\text{ton}} \times \frac{1 \text{ day}}{24 \text{ hours}} = 94 \text{ lb./hr.}$$

for the Reverb furnace

$$\frac{30 \text{ tons}}{\text{day}} \times \frac{85 \text{ lb.}}{\text{ton}} \times \frac{1 \text{ day}}{24 \text{ hours}} = 106 \text{ lb./hr.}$$

Sulphur is also added to the 40 ton kettles during refining. Data provided by the Company indicates that 60 lb. of sulphur are added in a 3 hour period. It was assumed that 50% of the sulphur would be evolved as SO_2.

$$Q = \frac{60 \text{ lb.}}{3 \text{ hr.}} \times \frac{50}{100} = 10 \text{ lb./hr.}$$

December 13, 1973
VS/hv

TORONTO REFINERS & SMELTERS LIMITED

ANNUAL EMISSIONS

1. The outlet grain loading from a baghouse is generally reported to be 0.01 grains/ft^3 by baghouse manufacturers. This figure is also generally used by the Approvals Section in dispersion calculations. Therefore, this figure was used in estimating the emissions from a baghouse serving lead kettles, reverberatory and blast furnaces at Canada Metal Company Limited and Toronto Refiners & Smelters Limited.

2. From the above figure, the blast furnace lead emission rate was calculated to be 1.0 lb per hour. The annual emission was based on 5000 hr of operation. Therefore, the annual emission rate is:

   $1.0 \times 5000 = 5000$ lb/yr

3. The hourly emission rate from the reverberatory furnace was 0.8 lb/hr and was calculated on the given exhaust concentration of 0.01 grains/ft^3.

   Based on 325 days/year operation, the annual emission rate is:

   $$24 \frac{hr}{day} \times 325 \frac{days}{yr.} \times \frac{0.8 \text{ lb}}{hr.} = 6240 \text{ lb/yr}$$

4. The melting pots (kettle furnaces) have an emission of;

   $$24 \frac{hr}{days} \times 300 \frac{days}{yr.} \times \frac{1.4 \text{ lb}}{hr} = 10{,}800 \text{ lb/yr.}$$

   The battery top crusher was found to have an emission of:

   $$8 \frac{hr}{day} \times 125 \frac{days}{yr.} \times \frac{0.1 \text{ lb.}}{hr.} = 100 \text{ lb/yr}$$

5. The total lead emissions were:

Blast Furnace	:	5,000 lb/yr.
Reverberatory Furnace	:	6,240 lb/yr.
Melting Pots (all)	:	10,080 lb/yr
Battery Top Crusher	:	100 lb/yr
		21,420 lb/yr

6. Based on the usage of 75 lb of CdO/week, the emissions are:

   $$\frac{75 \text{ lb/wk} \times 52 \text{ weeks} \times 70 \text{ lb emissions at Canada Metals}}{3300 \text{ lb used at Canada Metal}}$$

   = 82.7 lb of CdO/year

cont'd.....

7. Based on the usage of 13.5 tons of arsenic trioxide used at Toronto Refiners and Smelters Limited per year, the emissions are:

$$13.5 \frac{\text{tons}}{\text{yr.}} \times \frac{149.82}{197.82} \times \frac{450 \text{ lb of arsenic emissions at Canada Metals}}{75 \text{ tons of arsenic at Canada Metals}}$$

= 61 lb of arsenic per year.

December 14, 1973
JF/ng

SECTION 7.2

PHYTOTOXICOLOGY REPORTS ON

TORONTO REFINERS & SMELTERS LTD.

Bathurst Street
Toronto

Dr. S.N. Linzon
Chief, Phytotoxicology Section

Index to Section 7.2

PHYTOTOXICOLOGY SECTION
AIR MANAGEMENT BRANCH

INVESTIGATION SUMMARY REPORT

Location TORONTO

Date(s) of Investigation July 24, 26/72; Sept. 6/72; March 13/73; June 26/73; July 4/73; July 30-31/73; Aug. 20-21/73; Sept. 19/73; Nov. 21-22/73

Source TORONTO REFINERS AND SMELTERS, 28 BATHURST STREET

Nature of Investigation LEAD SURVEYS (SOILS AND VEGETATION)

Analyses Results (Tables, Maps, Sketches attached)

Attached are final reports for all surveys conducted in 1972 and 1973. These reports tabulate and discuss the analytical results. Preliminary reports which provide details on purposes of surveys, samples collected, and sample locations with maps are on file.

The key conclusions of these surveys are:

1. A survey conducted in July 1972 at 10 locations in the vicinity of Toronto Refiners and Smelters demonstrated exceedingly high lead contents in surface soil (8,250 ppm) 100 feet east and in not washed vegetation (6800 ppm) 20 feet north of the company. The not washed foliar samples possessed two to three times the amount of lead in washed samples indicating the presence of a high proportion of airborne particulate lead. Lead levels in soil and vegetation decreased with distance to the north from the company.

2. An expanded soil survey was conducted in March 1973 to delineate the extent of soil contamination in the vicinity of Toronto Refiners. The contaminated area (over 600 ppm in surface soil) extended to a distance of approximately 1500 feet east and west and 1200 feet north of the company. Statistically significant decreases in lead content in soil were shown with increasing distances to the E, NE, N, and W of the company.

3. The July 1972 survey was repeated one year later in which time the battery crusher was inoperative and the results showed a twenty-fold reduction in lead levels in tree foliage immediately north of the company.

4. In a fresh fruit and vegetable survey conducted in July 1973, none of 23 fresh fruit collections exceeded the Federal Health standard of 7 ppm lead, whereas six of 38 fresh vegetable collections exceeded the Federal standard of 2 ppm. Interpretation of all the analyses results indicated that the six excessive lead levels in fresh vegetables were due to surface contamination by soil.

5. A dust sampling survey conducted in August, 1973 showed that street dust collected near the refinery did not contain lead concentrations in excess of those found in dust on other streets in the city of Toronto. However, lead levels in undisturbed dust near the refinery were excessive when compared to similar dust - - -

. . .continued/

samples collected at a distance from the refinery. The area of residual soil lead contamination closely approximated the area possessing high levels of lead in undisturbed dust.

6. There was a general increase in lead levels in vegetation in the vicinity of the refinery during the period July 4 to September 19, 1973. The greatest increases were found immediately to the east, south and west of the refinery. Improvements in lead levels to the north of the company reflected relocations of operations on company property.

7. A soil survey to indicate depth and extent of lead contamination in the vicinity of Toronto Refiners was conducted in November, 1973. Soil contamination isopleths were drawn on a map showing the areas north of the company possessing over 500 ppm lead in soil to various depths.

Complaint: Ext. XX

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Surveillance

PHYTOTOXICOLOGY SECTION
AIR MANAGEMENT BRANCH

INVESTIGATION FINAL REPORT

Location TORONTO

Date(s) of Investigation July 24 & 26 /72

Source Toronto Refiners & Smelters
Survey requested by Abatement Section, AMB

Complaints W. Lachocki, 79 Niagara; G. Dias, 81 Niagara; R.McKinnon, 564 Wellington St.

Nature of Investigation Soil & Vegetation Survey for Lead Contamination

Description of Investigation

Soil and Vegetation Survey

Excessive levels of lead were detected in vegetation at distances up to 600 feet N and W, 1000 feet E, and greater than 150 feet S of the plant, with extremely high levels being detected in close to the N and E of the company property (see Table 1). Severe contamination of soil also was found to occur within this area; however, the actual limits of the area affected by the lead contamination were not defined in this survey. A comparison of the lead analyses for not-washed and washed vegetation indicated a ratio of 2-3:1 suggesting considerable surface lead contamination. No vegetation injuries attributed to the lead contamination were observed.

Complaint Investigations

Extremely high levels of lead were detected in foliar and soil samples collected on the Lachocki and Dias properties; however, only slightly higher than normal levels of lead were detected in vegetation on the McKinnon property (see Table 2). Tomato fruit collected on the Dias and Mckinnon properties contained levels of lead which were safe for human consumption, according to Federal Health Standards.

Conclusions:

Aerial lead emissions from TR & S have severely contaminated vegetation and soil in the vicinity of the plant. The complainant properties at 79 and 81 Niagara Street, immediately N of the smelter were the most adversely affected.

TABLE I

Chemical Analysis Results for Lead in Soil and Vegetation Collected in the Vicinity of Toronto Refiners and Smelters on July 24 and 26, 1972

Station No.	Distance and Direction from Source	Lead Content (parts per million-dry weight)		
		Ailanthus		Surface
		NW*	W**	Soil
1	150' S	246	76	4000
2	100' E	710	245	8250
3	400' ENE	291	96	575
5	500' NNE	330	71	2320
4	1200' NE	86	45	890
6	20' N	6800	2200	2350
7	200' N	530	280	1400
8	600' N	130	50	940
9	100 'W	295	80	2250
10	500' W	317	62	4000
Control	1.8 mile NE	48	30	365

*NW - analyzed as collected

**W - washed prior to analysis

TABLE 2

Levels of Lead in Vegetation and Soil Samples
Collected on Complainant Properties
in the Vicinity of Toronto Refiners and Smelters
on July 24 and 26, 1972

Name and Address of Complainant	Lead Content (ppm - dry weight)					Lead Content (ppm - fresh weight)	
	Ailanthus foliage		Tomato foliage		Surface Soil	Tomato fruit (Sept. 6 Survey)	
	NW*	W**	NW	W		NW	W
W. Lachocki 79 Niagara	6800	2200	-	-	2350	-	-
G. Dias 81 Niagara	-	-	14000	4000	4750	81.2	1.6
R. McKinnon 564 Wellington	130	50	117	33	-	0.3	0.3
Control Area	48	30	15	12	350	0.3	0.3

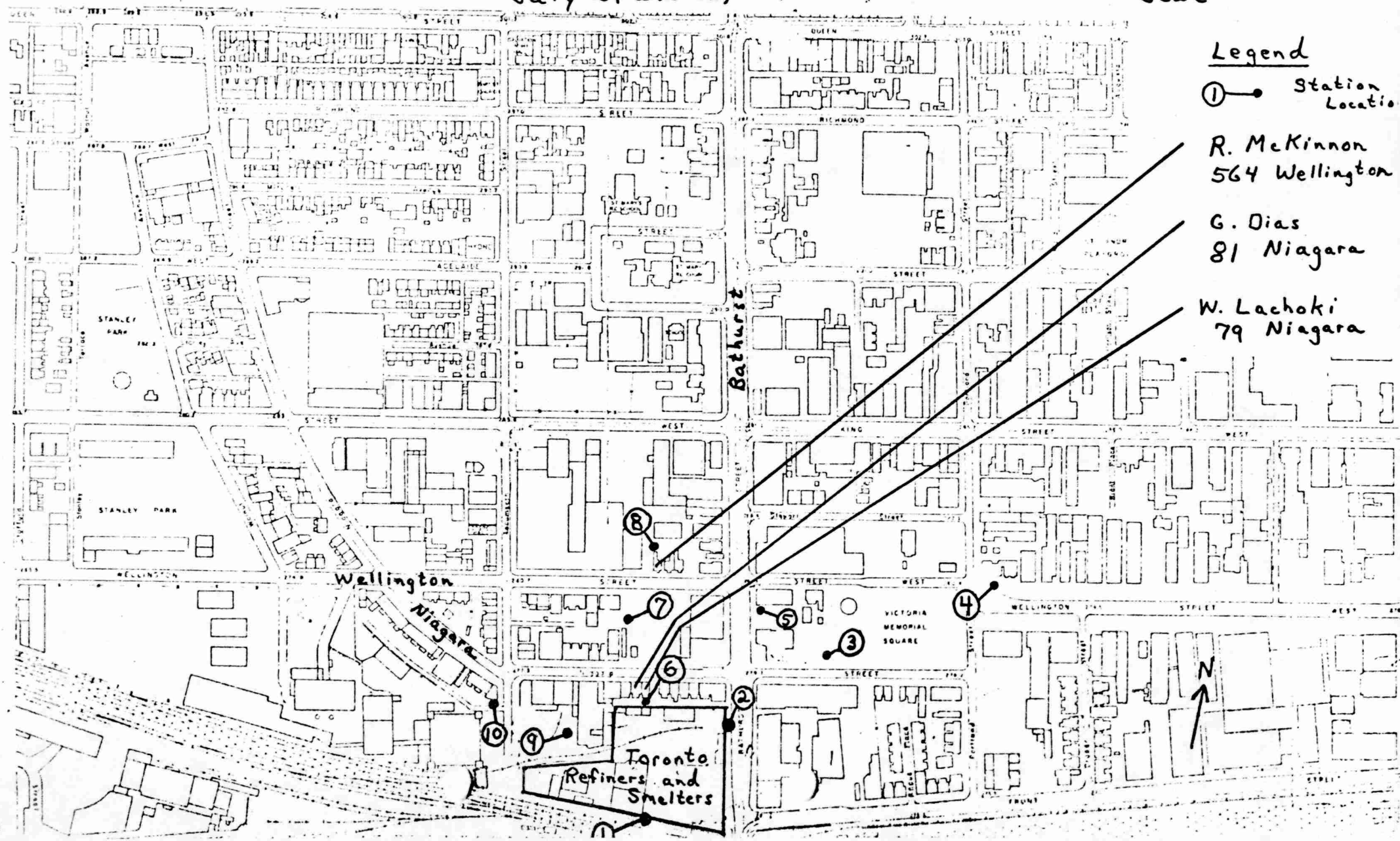
*NW - analyzed as collected

**W - washed prior to analysis

Vegetation and Soil Sampling in Vicinity of Toronto Refiners and Smelters

July 24 and 26, 1972

Scale: 1" = 400 ft



Complaint: Ext. XX

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PHYTOTOXICOLOGY SECTION
AIR MANAGEMENT BRANCH

INVESTIGATION FINAL REPORT

Location TORONTO

Date(s) of Investigation September 6, 1972

Source Toronto Refiners and Smelters

Complaint G. Regine, 73 Niagara St.

Nature of Investigation Alleged lead contamination of vegetation

Description of Investigation

No visible air pollution injury was observed on the complainant's property. The lead content of tomato fruit collected for analysis is shown below.

Sample Location	Lead Content of Tomato Fruit (ppm - fresh weight)	
	Not Washed	Washed
G. Regine, 73 Niagara St.	0.6	0.5
Control Area	0.3	0.3

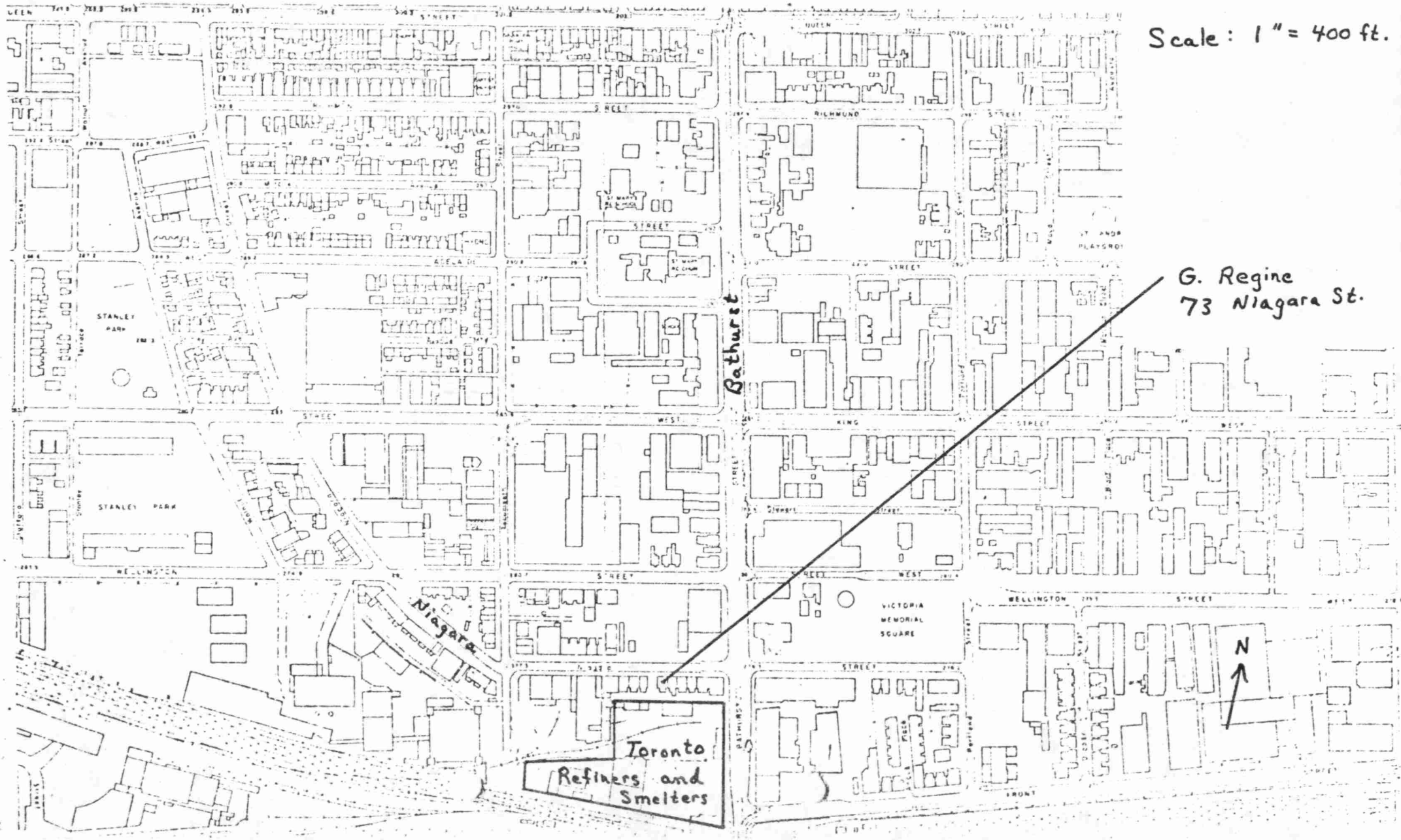
The lead content of the fruit is well below the maximum acceptable Federal Health limit of 7 ppm (fruit washed, fresh weight basis) and is safe for human consumption. Collections made at 2 other previous complainant properties have been reported and discussed in the July 24 and 26 report.

Conclusions:

No vegetation injury or lead contamination of tomato fruit was detected on the complainant's property.

Location of Complainant's Property in Relation to Toronto Refiners and Smelters

September 6, 1972



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PHYTOTOXICOLOGY SECTION
AIR MANAGEMENT BRANCH

INVESTIGATION FINAL REPORT

Location TORONTO

Date(s) of Investigation March 13, 1973

Source Toronto Refiners and Smelters

Complaint Requested by Medical Consultant to the AMB

Nature of Investigation Soil sampling survey for area of lead contamination

Description of Investigation

At the request of the Medical Officer of Health for Toronto, an extensive soil sampling survey was conducted in the vicinity of the plant. Samples of soil from the 0-2 and 2-4 inch depths were collected at increasing distances to the ENE, N, NW and W and from a control location to the NE.

Observations and Results

The lead analyses results for the soil sampling survey are shown in the attached table. Soil lead levels significantly above normal for an urban area were found from just beyond Draper St. on the east, Stewart and King Sts. on the north, and the intersection of Walnut and Wellington Sts. on the west (see attached map). This contaminated zone comprised an area approximately 1500 feet to the east and west, and 1200 feet to the north of the source, or approximately 0.2 square miles. The extremely high levels of lead detected in the 0-2 inch layer confirm the airborne nature of the contamination.

The correlation between the lead content of the 0-2 and 2-4 inch depths and sampling distance from the source is shown below:

Direction from Source	Correlation between Lead Content and Sampling Distance	
	0-2 inch soil depth	2-4 inch soil depth
E	-0.90*	-0.90*
NE	-0.99**	-0.95*
N	-0.93*	-0.95*
NW	-0.90*	-0.75

With one exception, the lead content of 0-2 and 2-4 inch soil layers decreased significantly with increasing distance to the E, NE, N and NW of the plant.

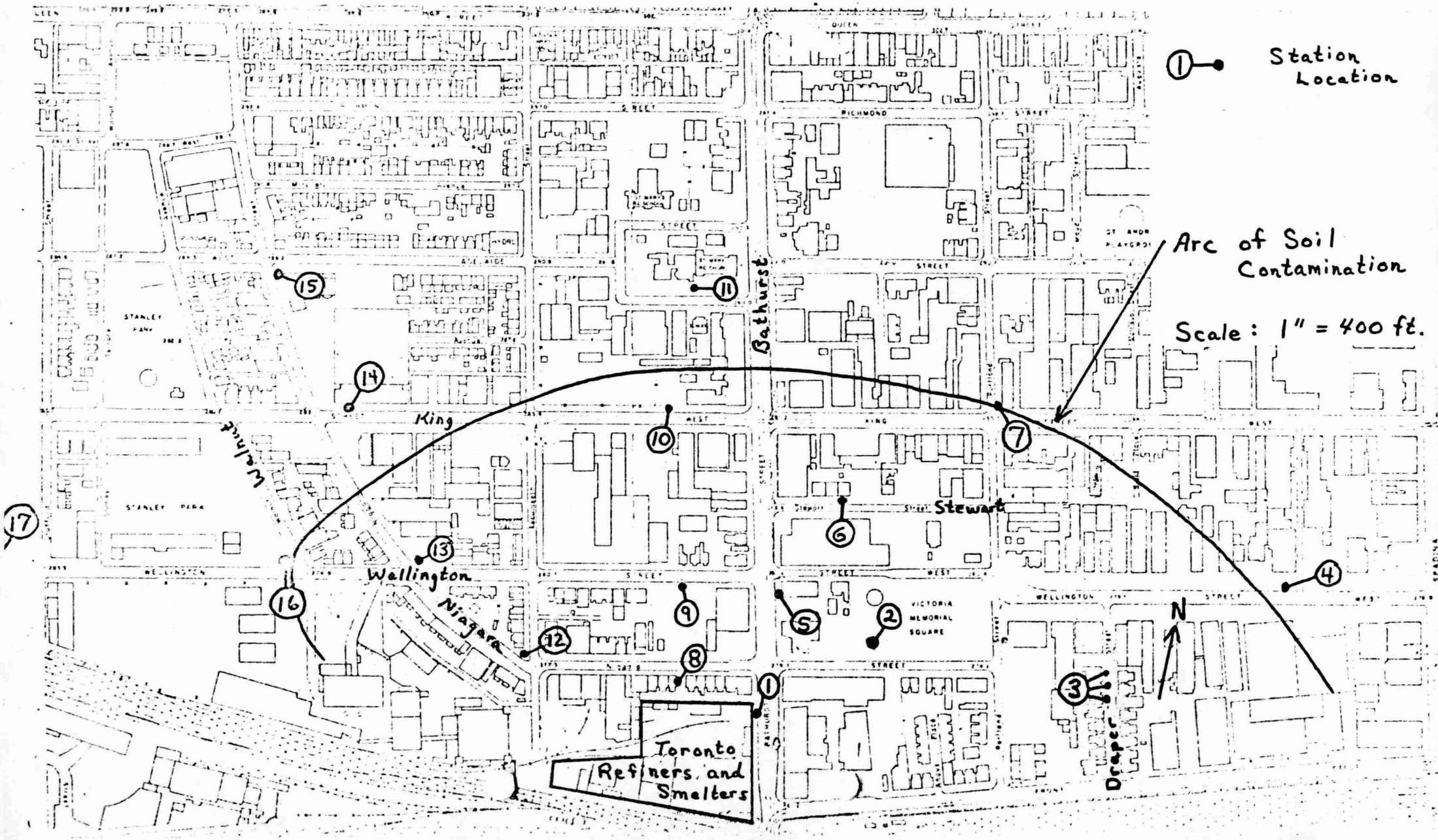
Summary

The results of this soil sampling survey have shown that soil in the vicinity of Toronto Refiners and Smelters has been contaminated with lead to a distance of approximately 1500 east and west and 1200 feet north. The highest levels of lead were detected in the 0-2 inch layer and were found to decrease significantly with increasing sampling distance to the E, NE, N and NW of the plant.

Lead content of soils collected in the vicinity of Toronto Refiners and Smelters, March 13, 1973

Station No.	Distance from Source	Lead content (ppm dry weight) 0 - 2"	2 - 4"
1	200' E	10,000	7,600
2	750' E	813	495
3	1500' E	1,375	800
4	2350' E	590	388
5	600' NE	2,300	1,175
6	1000' NE	1,325	1,025
7	1500' NE	615	728
8	50' N	11,950	5,500
9	300' N	1,400	1,075
10	850' N	1,300	875
11	1200' N	225	238
12	350' NW	1,475	630
13	725' NW	850	510
14	1250' NW	238	288
15	1575' NW	40	15
16	1100' W	623	460
17	2250' W	330	85
18 (Control)	2.5 miles NE	320	288

Soil Sampling Locations in Vicinity of Toronto Refiners and Smelters - March 13, 1973.



Complaint: Ext. 13

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Surveillance

PHYTOTOXICOLOGY SECTION
AIR MANAGEMENT BRANCH

INVESTIGATION FINAL REPORT

Location TORONTO

Date(s) of Investigation: June 26, 1973

Source Toronto Refiners and Smelters

Complaint Abatement Section, AMB

Nature of Investigation To determine lead content of replacement top soil

Description of Investigation

The lead content of the 3 soil layers was as follows:

Soil layer	Lead content (ppm - dry weight)
0-2	60
2-4	268
4-6	720

There are two possible factors which would account for the slightly higher levels of lead that were detected at increasing soil depths:

1. The soil either was not replaced to a uniform depth of 6 inches as was indicated or some mixing occurred during the replacement operations; as a result, one or more of the 20 soil probes probably was taken from old soil containing excessive lead levels.

2. A small amount of the lead from the old, contaminated soil at the 6 inch depth is moving up through the soil profile.

On the basis of the relative immobility of lead in a soil profile and the fact that the sampling was conducted shortly after the replacement date, factor No. 1 is the most likely explanation. Continued sampling next year should clarify this point.

Summary

A background starting level of 60 ppm lead in the 0-2 inch layer was established. Slightly higher lead levels were detected at increasing soil depths and are probably due to the absence of a uniform 6 inch layer of new soil over the old contaminated material or to partial mixing of the two soils during replacement operations.

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Surveillance

PHYTOTOXICOLOGY SECTION
AIR MANAGEMENT BRANCH

INVESTIGATION FINAL REPORT

Location TORONTO

Date(s) of Investigation July 4, 1973

Source Toronto Refiners & Smelters

Complaint Requested by Abatement Section, AMB R. Armstrong

Nature of Investigation Soil and Vegetation Survey for Lead Contamination

Description of Investigation

This survey which consisted of sampling soil and Ailanthus foliage for lead analysis from the same locations as on July 24,1972, was conducted just prior to the rescinding of the AMB Stop Order in early July 1973.

Observations and Results

The lead content of the soil and vegetation is shown in Table 1. Shown also are the corresponding lead analyses results for the 1972 samples.

Elevated levels of lead were detected in the washed foliage of Ailanthus trees growing in the area bounded by Wellington St. on the north, Tecumseth St. on the west and Bathurst St. on the east, with high levels being detected in the immediate vicinity of the plant. The lead content of the soil in this area also was extremely high, with the area of contamination extending to the boundaries that were previously established in the March 1973 soil survey.

Since lead is tenaciously held by soils, the levels in soil were relatively unchanged from 1972 to 1973. The fluctuations in the lead levels were due to the heterogenous nature of soil, and to the variabilities encountered in sampling. In contrast, it is apparent from these results that the lead content of the deciduous Ailanthus foliage generally was much lower in July 1973 than was found in July 1972. The nature and extent of this reduction is shown in Table 2. Samples collected to the north and north-east of the plant contained levels of lead that ranged from 32 to 96 % lower than in 1972. In each of these directions the greatest reduction in lead content was detected close to the plant and the size of the reduction decreased with increasing distance from the source. These figures reflect a marked decrease in airborne lead in the area which can be attributed to reduced emissions from the plant.

Complaint Investigation

Normal levels of lead were detected in vegetation collected on the property of Mr. R. Armstrong at 20 Draper St. Toronto (see Table 3). Above normal levels of lead were detected in the soil. These results indicate that airborne lead emissions are currently not a problem at this location and that the lead content in the soil is apparently of a residual nature.

Summary

1. There has been a marked reduction in the lead content of Ailanthus foliage compared to 1972; this reduction can be attributed to reduced emissions from plant.

2. Elevated levels of lead in vegetation are present in the vicinity of the plant in an area bounded by Bathurst, Tecumseth and Wellington Streets.

3. Extremely high levels of lead in soil are present in the immediate vicinity of the plant and the size of the area with soil contamination has not changed since the last sampling in March 1973.

TABLE I

Lead Content of Soil and Vegetation
Vicinity of Toronto Refiners and Smelters
July 24, 1972 and July 4, 1973

Station No.	Distance & Direction from Source	Lead Content (ppm - dry weight)					
		Ailanthus				Soil(0-4 Average)	
		July 24/72		July 4/ 73		July 24/72	July 4/73
		NW	W	NW	W		
1	150' S	246	76	155	86	4000	5625
2	100' E	710	245	125	52	8250	20590
3	400' ENE	291	96	59	22	575	612
5	500' NNE	330	71	98	48	2320	587
4	1200' NE	86	45	44	24	890	565
6	20' N	6800	2200	300	120	2350	6500
7	200' N	530	280	126	60	1400	877
8	600' N	130	50	48	22	940	375
9	100' W	295	80	650	220	2250	2187
10	500' W	317	62	260	110	4000	4500
Control	1.8 mile NE	48	30	34	11	365	212

TABLE 2

Percent Reduction in Lead Content of Ailanthus Foliage
During Period of Stop-Order
(Collections Made July 24,1972 and July 4, 1973)

Station No.	Distance and Direction from Smelter	Percent Reduction in Lead Content Ailanthus Foliage	
		Not Washed	Washed
1	150' S	37	+ 13
2	100' E	82	79
3	400' ENE	80	77
5	500' NNE	70	32
4	1200' NE	49	47
6	20' N	96	95
7	200' N	76	79
8	600' N	63	56
9	100' W	+ 120	+ 175
10	500' W	18	+ 77

\+ %increase in lead content
Lead content in ppm - dry weight

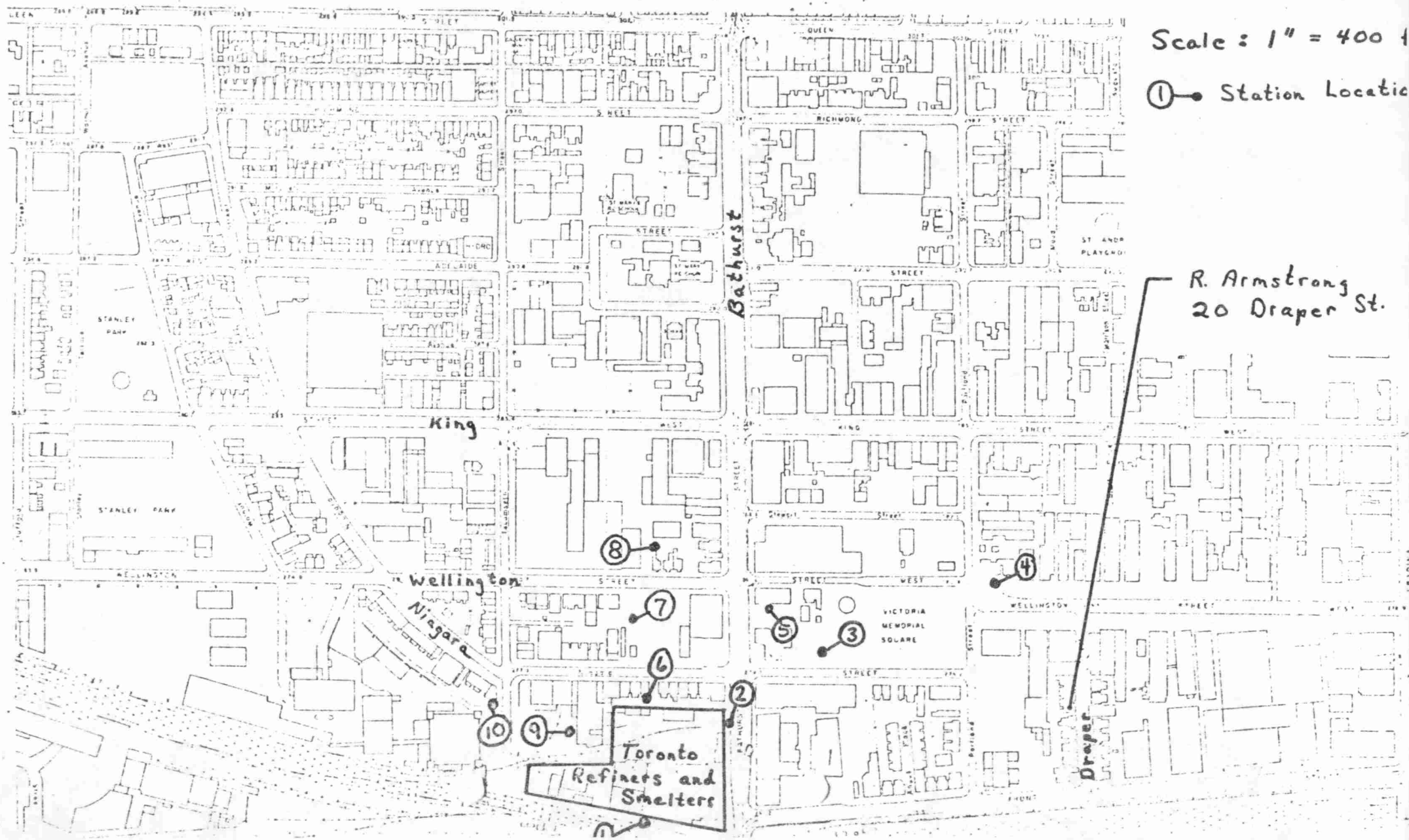
TABLE 3

Lead Content of Soil and Vegetation
R. Armstrong - 20 Draper St.
July 4, 1973

Sample Location	Lead Content (ppm - dry weight)					
	Ailanthus		Grass		Soil	
	NW	W	NW	W	0-2"	2-4"
R. Armstrong (20 Draper St.)	22	8	32	31	400	500
Control Area (1.8 miles NE)	34	11	-	-	225	200

NW not-washed
W washed

Vegetation and Soil Sampling Locations in Vicinity of Toronto Refiners and Smelters, July 4, 1973



Complaint: Ext. X

Int. X

Surveillance

PHYTOTOXICOLOGY SECTION
AIR MANAGEMENT BRANCH

INVESTIGATION FINAL REPORT

Location Toronto

Date(s) of Investigation July 30-31, 1973

Source Toronto Refiners and Smelters

Complaint Survey requested by Toronto Board of Health
~~(Seymour, Colacci, Armstrong, Lopez, Peel, Quinlan, Seymour, Newton)~~

Nature of Investigation Fruit and Vegetable Survey

Description of Investigation

Samples of fresh fruit, fresh vegetables, leaves, stems, roots and soil were collected for lead analysis from 27 locations within a 1500 foot radius of the plant. The sampling was requested by the Toronto Board of Health and was designed to determine if home grown fruit and vegetables were safe for human consumption. During the door-to-door sampling program, requests for information on lead content were received from 8 residents in the area (see above). A map showing the location of all samples is attached.

Observations and Results

The complete results of the fruit and vegetable survey are shown in Table 1, while Table II lists the average lead contents of fruit, lettuce, other leafy crops, beans, stem and root crops, and soil in which these crops were growing. Twenty-three fresh fruit samples were collected, most of which were tomatoes. All samples had lead levels well below 7 PPM, which is the maximum acceptable level for lead in fresh washed fruit, as set by the federal Health Protection Branch. The highest lead level among fruit samples was 1.1 PPM. Of the 38 fresh vegetable samples collected, six samples exceeded the Health Protection Branch maximum acceptable limit for lead in fresh washed vegetables of 2 PPM. Four of these samples were lettuce leaves, and two were root crops, horseradish and beets. It is likelythat high lead levels in these samples were due to surface contamination by soil, because garden soil in this area averaged 672 PPM in the upper two inches. However, this lead in the soil does not readily enter plants, and except for surface contamination, fresh fruits and vegetables collected around Toronto Refiners were safe to eat.

Summary

1. All samples of fruit were found to be safe for human consumption.
2. Six of the 38 vegetable samples contained excessive levels of lead which were attributed to surface contamination by soil.

TABLE I

TORONTO REFINERS FRESH FRUIT AND VEGETABLE STUDY - JULY 30, 1973

Location	Sample	Pb Content, PPM fresh N W	fresh W	dry	dry N W	dry W
Mrs. M. Seymour* 593 Wellington	Tomato Fruit	0.2	0.2			
	Tomato leaves				32	21
	Lilac leaves				90	26
	Lettuce (front of house)	29	14.5			
	Garden soil 0-2"			773		
	2-4"			785		
	Lawn soil 0-2"			585		
	2-4"			483		
587 Wellington	Lettuce	3.1	1.1			23
	Radish leaves	7.3	8.0		125	72
	Radishes	1.2	0.7			13
	Tomato fruit	0.2	0.2			6
	Tomato leaves				52	44
	Yellow beans (fruit)	0.7	1.0			11
	Bean leaves				155	77
	Kohlrabi leaves				16	14
	Kohlrabi stem (edible)	1.3	0.4			7
	Kohlrabi roots	3.2	2.0			
	Garden soil 0-2"			658		
	2-4"			586		
	Lawn soil 0-2"			260		
	2-4"			410		
Mrs. S. Peel*	Parsley [a]		4.0			
605 Wellington	Turnip tops [a]	11.6	7.5		36	26?
	Lawn soil 0-2"			568		
	2-4"			590		
	Garden soil 0-2"			553		
	2-4"			580		

[a] Insufficient sample for accurate analysis

* Complainant

Location	Sample	Pb Content, PPM fresh N W	fresh W	dry	dry N W	dry W
585 Wellington	Raspberry fruit	1.4	0.9			
	Raspeberry leaves				46	22
	Apple fruit	0.6	0.4			10
	Apple leaves				101	42
	Beets, leaves	5.4	1.6		75	42
	Beets, fresh	50	2.1			
	Tomato fruit	0.4	0.4			8
	Lettuce	10.2	2.6			79
	Garden soil 0-2"			1070		
	2-4"			1020		
	Street soil 0-2"			708		
	2-4"			560		
615 Wellington* Mr. J. Seymour	Tomato fruit	0.2	0.2			8
	Tomato leaves				52	15
	Lawn soil 0-2"			1210		
	2-4"			1270		
	Garden soil 0-2"			785		
	2-4"			833		
617 & 619 Wellington	Green peppers	0.3	0.3			6
	Peppers, leaves				22	12
	Cucumbers, fruit	0.2	0.2			8
	Cucumber, leaves				29	25
	Cabbage stem	0.4	0.4		10	5
	Cabbage roots				92	27
	Cabbage leaves				11	7
	Onion bulbs	0.3	0.4			7
	Onion leaves	3.3	0.6			12
	Garden soil 0-2"			813		
	2-4"			758		
564 Wellington	Horseradish, root	2.5	2.1			15
	Horseradish leaves	7.7	2.4		20	5
	Mixed soil 0-2"			565		
	2-4"			525		

Location	Sample	Pb Content fresh N W	fresh W	dry N W	dry W
40 Tecumseh	Tomato fruit	0.2	0.2		5
	Tomato leaves			14	9
	Garden soil 0-2"			538	
	2-4"			450	
	Lawn soil 0-2"			588	
	2-4"			438	
32 Tecumseh	Cabbage roots				31
	Cabbage leaves (edible)	2.5	1.0	11	7
	Cabbage stem			13	4
	Garden soil 0-2"			1260	
	2-4"			1650	
633 Wellington	Tomato fruit	0.3	0.3		
	Tomato leaves			57	36
	Green peppers, fruit	0.3	0.3		
	Peppers, leaves			19	15
	Cabbage head (inner)	0.6	0.4	3	2
	Cabbage leaves (outer)	1.7	1.5	14	12
	Cabbage roots			11	7
	Garden soil 0-2"			85	
	2-4"			68	
161 Niagara*	Radish leaves			35	13
	Radishes fresh	1.2	0.7		7
Mr. M.J. Colacci	Turnip tops			45	32
	Turnips, fresh	0.9	0.6		5
	Lettuce	4.2	1.8	104	41
	Lawn soil 0-2"			73	
	2-4"			573	
	Garden soil 0-2"			198	
	2-4"			288	

Location	Sample	Pb Content fresh N W	fresh W		dry N W	dry W
Mr. R. Newton*	Tomato fruit	0.4	0.4		2	2
153 Niagara	Beets, fresh	2.0	0.8			4
	Beet leaves	4.7	2.1		47	20
	Beans, fruit	1.1	0.6			3
	Bean leaves				38	20
	Radishes	1.1	0.8			11
	Radish leaves				23	23
	Garden soil 0-2"			705		
	" " 2-4"			725		
135 Niagara	Tomato fruit	0.4	0.4			9
	Tomato leaves				85	25
	Green beans, pods	1.3	0.7			5
	Bean leaves				69	25
	Cabbage roots				20	16
	Cabbage leaves (outer)				17	14
	Cabbage head (inner)	0.7	0.7		2	
	Garden soil 0-2"			655		
	2-4"			715		
121 Niagara	Beans, pods	1.2	0.8			
	Bean leaves				87	24
	Lettuce, leafy	22.0	4.6			
	Cabbage roots				44	6
	Cabbage leaves	3.6	1.9			15
	Garden soil 0-2"			788		
	2-4"			853		
556 Wellington	Apple fruit #1	1.1	1.1			
	Apple leaves #1				118	47
	Apple fruit #2	0.8	0.5			
	Apple leaves #2				128	53
	#1 var. "Dutchess"					
	#2 var. "Spy"					

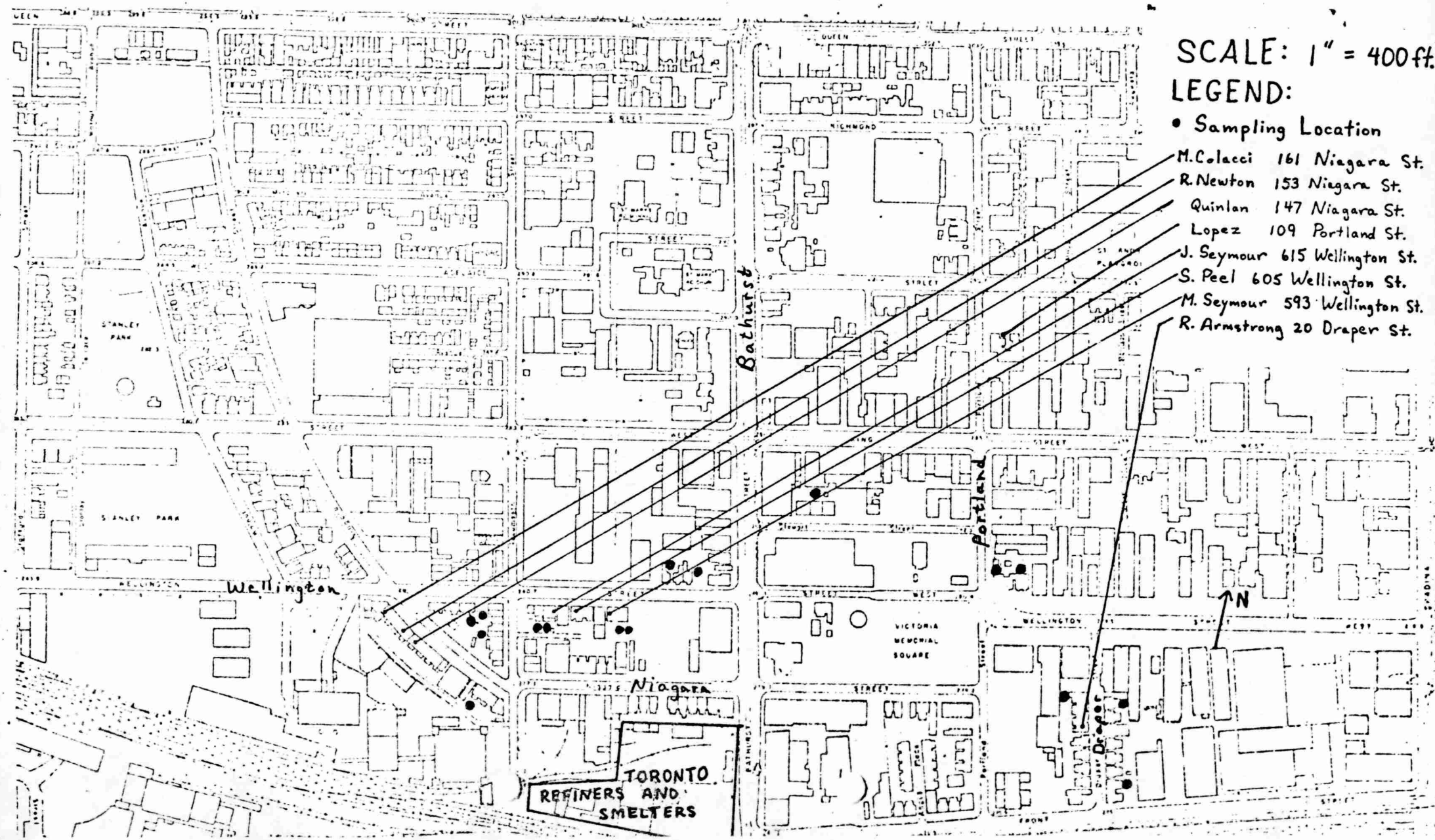
Location	Sample	Pb Content fresh N W	fresh W		dry N W	dry W
52 Stewart	Tomato fruit	0.6	0.5			
	Tomato leaves				50	28
	Lettuce, leafy	18.0	1.7			
	Celery, fresh	2.0	1.7			
	Garden soil 0-2"			785		
	2-4"			813		
520 Wellington	Cult. grapes, fruit	0.6	1.0		7	
	Grape leaves				80	44
	Lawn soil 0-2"			468		
	2-4"			460		
512 Wellington	Tomato fruit	0.5	0.5		3	
	Lettuce, leafy	4.7	1.3		31	
	Onion bulbs	2.6	1.0			
	Onion leaves				24	17
	Garden soil 0-2"			335		
	2-4"			328		
30 Draper	Tomato fruit	0.5	0.5		2	
	Cabbage roots				18	6
	Cabbage leaves (outer)	2.4	1.8		18	18
	Cabbage head (inner)	1.3	1.0		4	
	Garden soil 0-2"			670		
	2-4"			613		
Mr. R. Armstrong*	Beets, fresh	2.1	1.1			
	Beets, leaves	3.7	1.4			19
	Rhubarb leaves				6	6
	Rhubarb stalks	0.4	0.9		7	
	Radishes, fresh	3.1	0.7			
	Radish leaves				50	15
	Garden soil 0-2"			448		
	2-4"			438		

Location	Sample	Pb Content fresh N W	fresh W	dry N W	dry W
3 Draper St.	Peach fruit	1.8	0.6		
	Peach leaves			42	6
27 Draper	Cauliflower leaves	1.9	1.1	5	5
	Garden soil 0-2"		510		
	2-4"		560		
Frank Lopez*	Tomato fruit	0.4	0.4	3	
109 Portland	Tomato leaves			12	5
	Lettuce, leafy	5.4	2.4		
	Garden soil 0-2"		1080		
	2-4"		838		
109 Walnut	Tomato fruit	0.3	0.3		
	Lettuce, leafy	3.0	1.6		
	Turnips, fresh	3.2	0.8		
	Turnip leaves	3.4	1.8		
	Garden soil 0-2"		733		
	2-4"		748		
Mr. P. Quinlan*	Tomato fruit	0.3	0.3		
147 Niagara St.	Tomato leaves			91	25
	Lawn soil 0-2"		290		
	2-4"		323		
	Garden soil 0-2"		385		
	2-4"		415		

TABLE II - Average lead levels in fresh washed fruit and vegetables, and in garden soil collected near Toronto Refiner and Smelters

Sample	Lead Content, PPM	
	Average	Range
Fruit	0.43	0.2 - 1.1
Lettuce	3.50	1.1 - 14.5
Leafy vegetables	1.24	0.4 - 1.9
Beans (whole pods)	0.77	0.6 - 1.0
Stem crops	1.00	0.4 - 1.7
Root crops	1.01	0.6 - 2.1
Garden soil 0-2 inches	672	198 - 1260
2-4 inches	681	288 - 1650

LOCATION OF FRUIT AND VEGETABLE SAMPLING LOCATIONS, AND EIGHT COMPLAINANT PROPERTIES IN THE VICINITY OF THE TORONTO REFINERS AND SMELTERS PLANT, TORONTO



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PHYTOTOXICOLOGY SECTION
AIR MANAGEMENT BRANCH

INVESTIGATION FINAL REPORT

Location TORONTO

Date(s) of Investigation August 20-21, 1973

Source Toronto Refiners and Smelters

Complaint Requested by Director AMB

Nature of Investigation Dust Sampling Survey

Description of Investigation

This survey was designed to determine the extent to which dust on streets and in undisturbed locations contributed to lead contamination in the area.

The sampling locations were selected to correspond with a soil sampling survey which was conducted by the Phytotoxicology Section on March 13, 1973. Accordingly sixteen sites located at increasing distances to the E, NE, N, NW and W of the plant were sampled. Control samples were collected at 0.6 and 3 miles N and 1 mile NNW. The surfaces sampled can be grouped into two main categories:

1. paved streets
2. other surfaces - (excludes all surfaces subject to normal vehicular movement)
   - window ledges
   - sewer covers (metal)
   - asphalt (driveways, street shoulders; private parking lots and playgrounds)

A sample of dust from the street was collected at each site. Sampling from other surfaces varied according to the site characteristics.

Observations and Results

The percent of lead in the dust samples collected from streets and other surfaces is shown in Table 1. Shown also for comparative purposes is the lead content of the corresponding samples of soil (0-2 inch layer) which were collected five months earlier.

(i) Dust from street surfaces

The percentage of lead in dust collected on street surfaces ranged from 0.31 to to 1.10%. With one exception, the lead content of dust collected from streets close to the source was similar to that of dust collected from streets in control areas. The exception was the elevated level of 1.1% lead in dust collected from Bathurst Street at Station 1, immediately east of the source.

A statistical comparison of the street dust lead results with the lead content of soil samples collected in March yielded a non-significant "r" value of 0.37.

(ii) Dust from other surfaces

The composition of dust collected from surfaces other than paved streets, ranged from 0.20 to 7.72%, with the highest levels being detected near the plant. Lower

levels generally were detected at increasing distances in each direction from the plant. A statistical comparison of these results with the corresponding soil analyses, revealed highly significant (1% level) "r" values of 0.77 and 0.90 respectively for the 0-2 and 2-4 inch soil layers. The area of lead contamination, based on (i) the dust samples and (ii) the soil samples is shown within the areas on the attached map. It is readily apparent that these two methods of defining the lead contamination problem have yielded remarkably similar findings.

In an effort to check the validity of these findings, comparisons were made between the lead content of the dust samples at Stations 1 and 12 and corresponding lead values from hi-volume samplers operating at these locations.

Sampling Location	Average % lead in hi volume samples Apr. - Aug. 1973	Average* lead (%) in dust samples** collected Aug. 20, 1973
Station 1 (High volume 31018) Bathurst Street	2.05	2.02
Station 12 (High volume #31057) Tecumseth Street	2.68	1.85

* values shown are extrapolated to correspond with location of hi-volume sampler

** values shown are from surfaces not travelled by vehicular traffic

The percentage composition of lead in the two types of samples was found to be similar at the two locations.

Summary

The results of the dust sampling program which was conducted in the vicinity of the Toronto Refiners and Smelters plant, Toronto, can be summarized as follows:

1. the lead content of dust collected from street surfaces near the plant was similar to lead content of dust samples from streets in control areas

2. the lead content of dust from other surfaces was highest in those samples collected near the plant and decreased with distance in each direction from the plant

3. the lead content of dust samples collected from surfaces near the plant was similar to the lead content (%) of dust collected in two high volume analyzers

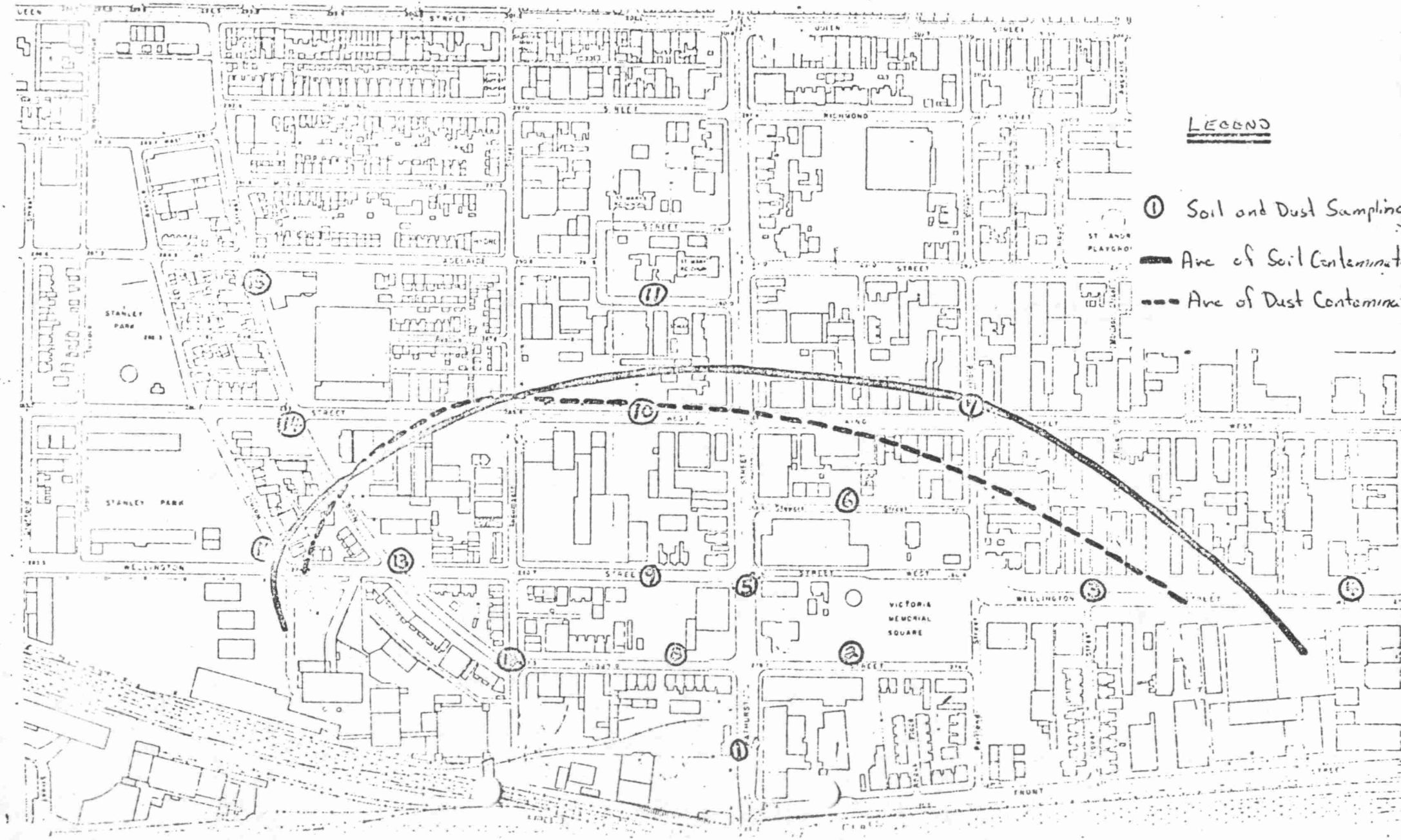
4. the area affected by lead contaminated dust very closely resembled the area of soil contamination as mapped in a previous Phytotoxicology report.

TABLE I

Lead Content of Dust and Soil Collected in the Vicinity of Toronto Refiners and Smelters, Toronto

Station No.	Distance from Source	Lead Content of Dust (%)		Lead Content of Soil (ppm) - dry weight
		Street Surfaces	Other Surfaces	(0-2 inch layer)
1	200' E	1.10 (Bathurst)	7.72, 1.81	10 000
2	750' E	0.61 (Niagara)	1.07	813
3	1500' E	0.45 (Wellington)	0.82	1 375
4	2350' E	0.49 (Wellington)	-	590
5	600' NE	0.50 (Bathurst)	0.40	2 300
6	1000' NE	0.60 (Stewart)	0.54	1 325
7	1500' N	0.52 (Portland)	0.24	615
8	50' N	0.31 (Niagara)	2.23, 1.47	11 950
9	300' N	0.55 (Wellington)	0.97	1 400
10	850' N	0.46 (King)	-	1 300
11	1200' NW	0.38 (Adelaide)	0.24	225
12	350' NW	0.67 (Tecumseth)	1.47	1 475
13	725' NW	0.46 (Wellington	0.67	850
14	1250' NW	0.31 (King)	-	238
15	1575' NW	0.41 (Niagara)	0.32	40
16	1100' W	0.37 (Walnut)	0.47	623
Controls	0.6 mi N	0.42 (Bathurst)	0.48	-
	3.0 mi N	0.78 (Bathurst)	0.43	-
	1.0 mi NNW	0.34 (Dovercourt)	0.20	-
	2.5 mi NW	-	-	320

Map Showing Location of Soil and Dust Sampling Stations in the Vicinity of TR & S and the Respective Areas of Lead Contamination, 1973



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Surveillance

PHYTOTOXICOLOGY SECTION
AIR MANAGEMENT BRANCH

INVESTIGATION FINAL REPORT

Location TORONTO

Date(s) of Investigation September 19, 1973

Source Toronto Refiners and Smelters

Complaint Requested by Abatement Section

Nature of Investigation Soil and Vegetation Survey for Lead Contamination

Description of Investigation

This survey was conducted approximately 10 weeks following the cessation of the AMB Stop Order on the battery crusher and was intended as a means of evaluating the effectiveness of the lead emission controls that had been installed on the crusher.

Samples of Ailanthus foliage and soil from the 0-2 and 2-4 inch layers were collected for lead analysis from 11 previously established sampling locations (July 4, 1973, July 24, 1972). The location of each sampling site is shown in the attached map.

Observations and Results

The lead content of the soil and vegetation samples is shown in Table 1. Excessive levels of lead were present in vegetation in an area extending to the north-east of the plant as far as the intersection of Portland and Wellington Sts. The area immediately north of the plant was much less severely affected than in previous surveys with the lead content of vegetation just approaching excessive levels. Excessive levels also were present to the immediate south and to the west as far as Tecumseth Street. Little or no change was detected in the severity of soil contamination compared to previous surveys. The size of the area of soil contamination also remained unchanged from the boundaries established during the March 1973 survey.

For comparative purposes, the lead contents (not washed) of Ailanthus foliage collected from the 11 permanent sampling sites in July and September, 1973 and July 1972 are shown in Table 2.

The effects of the AMB stop work order (battery crusher) on the lead content of vegetation collected in July 1973 has been discussed (INVESTIGATION FINAL REPORT- July 4, 1973). It was reported that the cessation of battery crushing operations at the plant resulted in a marked decrease (up to 96%) in the lead content of vegetation in the vicinity of the plant. However, high and in some cases, excessive lead levels still were present in the immediate vicinity of the plant.

The use of the September 1973 lead levels in vegetation as an indication of the effectiveness of the controls that were installed on the crusher prior to its start up in July 1973 depends on an understanding of the exposure periods. The lead detected on the foliage in July 1973 was deposited over an approximate 5 week period during which time the crusher was inoperative; the lead detected in September was deposited on the foliage over the same 5 week period and for an additional 10 week period during which time the crusher was operating. Because of these differences, a simple comparison of the two sampling dates is of little value. However, if we assume that lead deposited on vegetation during the first five weeks of the growing

season would continue to have been deposited at this rate for the next 10 weeks, it is possible to predict what the lead levels would have been in September had the battery crusher remained closed all summer. A comparison of these "predicted lead levels" with the actual September levels then would yield the approximate contribution of the 'controlled' crusher to the background lead emissions from other sources within the plant. The actual and predicted levels are shown in Table 3. In only one case (Station #3) was the actual levels much higher than the predicted figure. At the remainder of the stations, the actual lead content either was less than or similar to the predicted level. These comparisons indicate that the higher lead levels detected in September have resulted from ongoing lead emissions from other sources in and around the plant and that the lead emission controls installed on the battery crusher appeared to be effective.

Summary

1. Excessive levels of lead were detected in vegetation in a zone extending to the NE as far as Portland and Wellington; in the immediate vicinity to the north and south; and to Tecumseth on the west.

2. A comparison of actual and predicted lead levels in vegetation has shown that these excessive levels probably are due to various sources in and around the plant, and that the controls on the battery crusher are effective.

3. The greatest improvement in the degree of lead contamination compared to previous surveys was detected to the north and may reflect source re-locations on company property.

4. The area of residual lead contamination of soil has not changed since the March 1973 survey.

TABLE I

Lead Content of Soil and Vegetation
Vicinity of Toronto Refiners and Smelters
September 19, 1973

Station No.	Distance and Direction from Source	Lead Content (ppm-dry weight) Ailanthus Foliage NW	Ailanthus Foliage W	Soil 0-2"	Soil 2-4"
1	150' S	339	378	4850	1530
2	100' E	308	231	4050	1980
3	400' ENE	249	74	650	448
5	500' NNE	174	123	625	675
4	1200' NE	128	81	343	278
11	1350' E	49	20	1400	705
6	50' N	168	74	2950	4130
7	200' N	68	47	1080	718
8	600' N	151	89	775	800
9	100' W	290	200	1730	670
10	500' W	370	200	1200	1130
Control	1.8 mile NE	48	20	403	298

NW - not washed
W - washed

TABLE 2

Lead Content of Ailanthus Foliage Collected
in the Vicinity of Toronto Refiners and Smelters
July 24,1972 - July 4, 1973 - September 19, 1973

Station No.	Distance and Direction from Source	Lead Content (ppm - dry weight) Ailanthus foliage (not washed)		
		July 24/72	July 4 /73	Sept. 19/73
1.	150' S	246	155	339
2	100' E	710	125	308
3	400' ENE	291	59	249
5	500' NNE	330	98	174
4	1200' NE	86	44	128
11	1350' E	-	22	49
6	20' N	6800	300	168
7	200' N	530	126	68
8	600' N	130	48	151
9	100' W	295	650	290
10	500' W	317	260	370
Control	1.8 miles NE	48	34	48

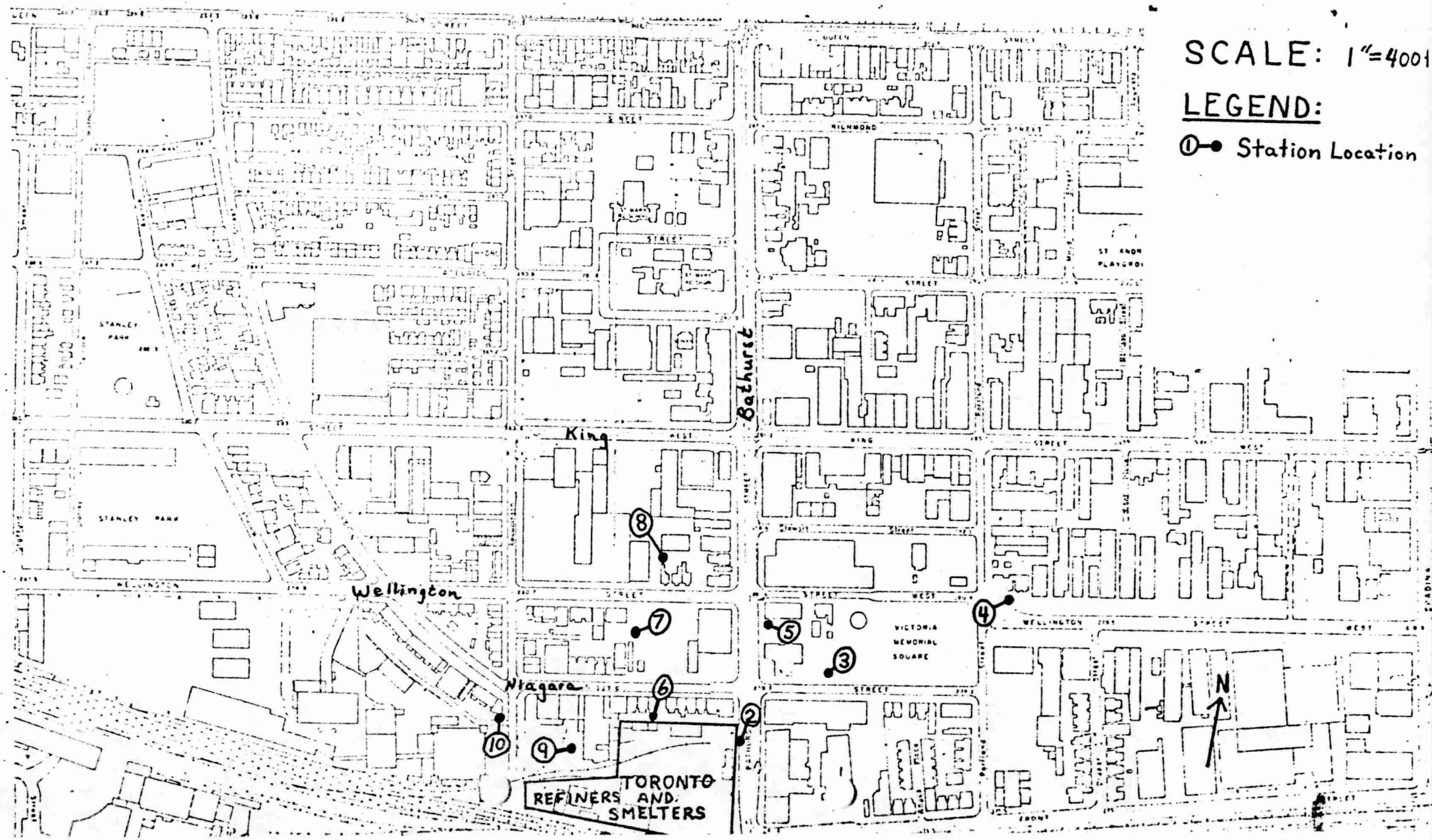
TABLE 3

Actual and Predicted
Lead Content of Ailanthus Foliage (Not Washed)
as of September 19, 1973

Station No.	Distance and Direction	Lead Content (ppm - dry weight) Actual	Predicted	Variance
1	150' S	339	465	less
2	100' E	308	375	less
3	400' ENE	249	177	more
5	500' NNE	174	294	less
4	1200' NE	128	132	same
11	1350' E	49	66	same
6	20' N	168	*	-
7	200' N	68	378	less
8	600' N	151	144	same
9	100' W	290	1950	less
10	500' W	370	780	less

* prediction not valid due to change in sample location from July 4 to September 19, 1973

VEGETATION AND SOIL SAMPLING IN VICINITY OF TORONTO REFINERS AND SMELTERS SEPTEMBER 19, 1973.



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PHYTOTOXICOLOGY SECTION
AIR MANAGEMENT BRANCH

INVESTIGATION FINAL REPORT

Location TORONTO

Date(s) of Investigation November 21 & 22, 1973

Source Toronto Refiners & Smelters

Complaint Surveillance Study

Nature of Investigation to determine depth of soil contamination

Description of Investigation

The purpose of this survey was twofold:

1. to determine the depth to which soil is contaminated in the vicinity of the company in the event that replacement is necessary, and
2. to study the possibility of any lead contamination originating from lower geological materials.

At each station shown on the attached map (station locations correspond to those of the March 13, 1973 soil survey), soil samples were taken to a depth of 16 inches and separated for lead analysis into four-inch increments as follows: 0-4, 4-8, 8-12, and 12-16 inches.

Observations and Results

The lead content of all soil samples is shown in Table I. Using the value of 500 ppm as an indication of excessive lead levels in soil, contamination isopleths for each of the 4 soil depths have been drawn on the attached map. This map could be used as a basis for determining excavation depth in the event that soil replacement becomes necessary.

It is apparent also from this map that lead is not originating from lower geological materials. The severity of contamination at lower soil depths was found to decrease with increasing distance from the plant.

Summary

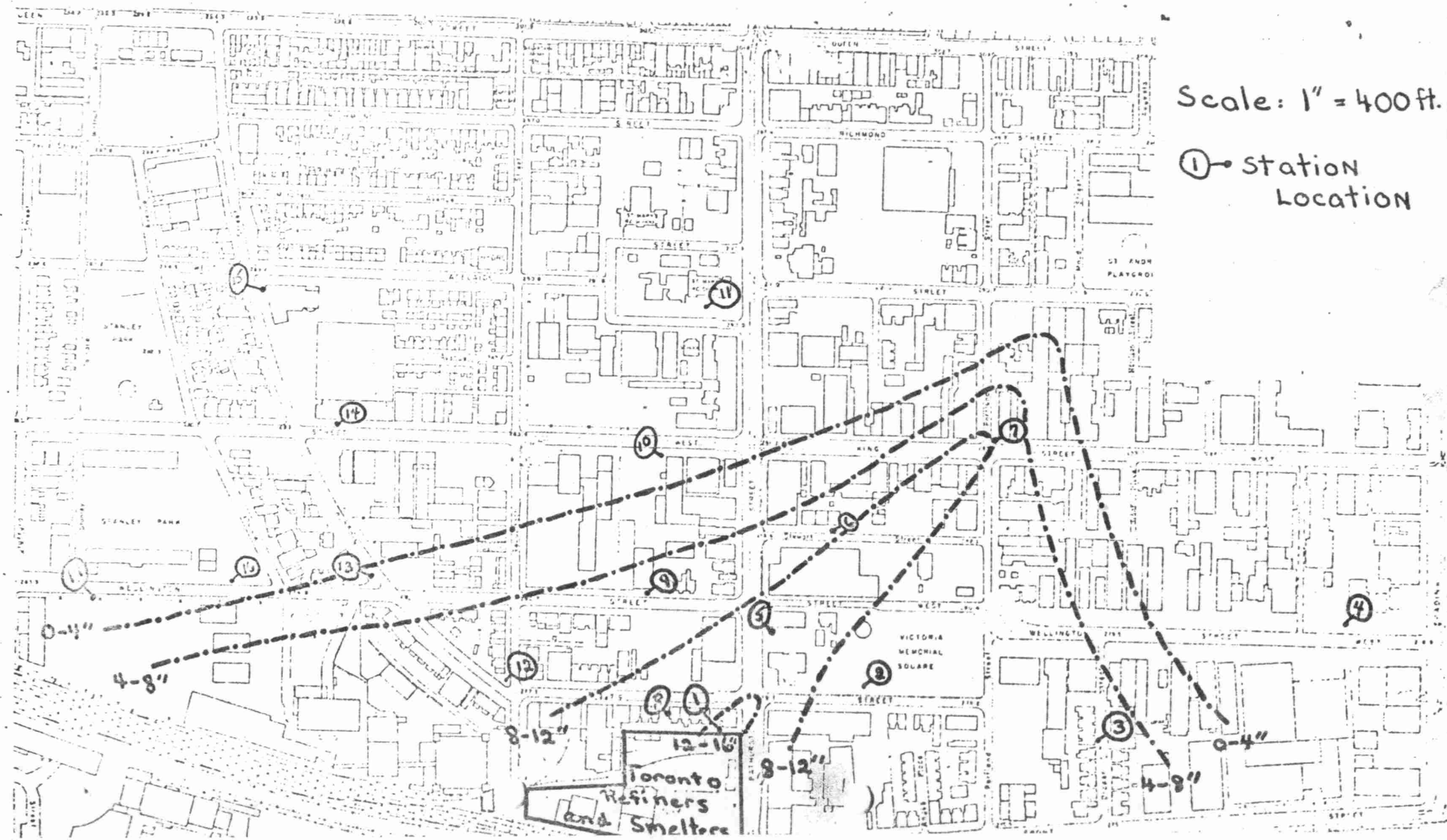
Using the value of 500 ppm as an indication of excessive lead levels in soil, a map showing contamination isopleths for the four soil depths has been prepared. This map could be used as a basis for determining excavation depth in the event that soil replacement becomes necessary.

TABLE I

LEAD CONTENT OF SOILS COLLECTED IN THE VICINITY OF TORONTO REFINERS AND SMELTERS, NOVEMBER 21-22, 1973

Station No.	Distance from Source	Lead Content (ppm - dry weight) 0-4"	4-8"	8-12"	12-16"
1	100' ENE	208	1060	1280	1130
2	750' E	535	280	120	330
3	1500' E	608	528	53	88
4	2350' E	295	173	80	40
5	600' NE	1600	740	388	233
6	1000' NE	920	1180	950	135
7	1500' NE	868	738	570	228
8	50' N	5380	7180	775	228
9	300' N	1080	520	210	80
10	850' N	363	450	165	88
11	1200' N	265	155	93	75
12	350' NW	945	503	345	135
13	725' NW	570	508	93	28
14	1250' NW	155	120	25	30
15	1575' NW	45	23	25	80
16	1100' W	433	258	153	15
17	2250' W	625	11800	140	30

Depth of Soil Contamination in the Vicinity of Toronto Refiners and Smelters, November 1973



SECTION 7.3

PRELIMINARY FINDINGS ON BLOOD LEAD LEVELS IN THE VICINITY OF TORONTO REFINERS & SMELTERS LIMITED

28 Bathurst Street
Toronto

Dr. G.J. Stopps
Senior Medical Consultant

SECTION 7.3

BLOOD LEAD LEVELS AT TORONTO REFINERS

No findings available for inclusion in this report.

SECTION 8

REPORT ON AIR QUALITY IN THE VICINITY OF CANADA METALS & TORONTO REFINERS & SMELTERS TORONTO, ONTARIO

L. SHENFELD.

INDEX TO SECTION 8

AIR QUALITY IN THE VICINITY OF CANADA METALS AND TORONTO REFINERS AND SMELTERS, TORONTO, ONTARIO

1. Introduction

Lead has been considered an ambient air contaminant in urban areas in general as a result of its emission from automotive sources. Urban measurements have been carried out over many years in the vicinity of high traffic arteries. Air quality and soil investigations have more recently been made in areas surrounding lead smelting and lead using industries.

The Ontario criteria for desirable ambient air with respect to lead were set at 15 ug/m^3 for a 24-hour period based on the American Industrial Hygiene Association recommended Threshold Limit Value of 150 ug/m^3 for an 8-hour period. Our criteria for contaminants when related to health effects were set at 1/10 the T.L.V. as a safety measure.

Our recent investigations of soil in the vicinity of secondary lead smelting industries have indicated that contamination may occur where frequent concentrations in excess of 5 ug/m^3 of lead are measured over 24-hour periods and where lead in the dustfall collected over a month is in excess of 0.3 tons/sq. mile or 105 $mg/m^2/30$ days. It is proposed that these criteria be adopted as desirable objectives on the basis that over a period of time frequent levels in excess of these will cause the contamination of soil.

Criteria for desirable ambient air with respect to total suspended particulate matter are 90 ug/m^3 for a 24-hour measurement and 60 ug/m^3 for the annual geometric mean. For total dustfall the

criteria for desirable ambient air are 20 tons/sq. mile/30 days and 13 for an annual average. Converted to metric units these values are 7.0 and 4.55 gms/m^2/30 days respectively. For sulphur dioxide the criteria are as follows:-

0.25 ppm for 1 hour average

0.10 ppm for 24-hour average

and

0.02 ppm for an annual average

2. Method of Measurement

(a) Suspended Particulate Matter

High-volume samplers are used to measure suspended particulate matter concentrations. The samplers are operated for 24-hour periods during which time approximately 2,000 cubic metres of air are pumped through standard preweighed filters. At the end of the 24-hour period the filters are removed and weighed to determine the amount of suspended particulate matter deposited. The units of measurement are in micrograms per cubic metre of air. The small suspended particles measured by this sampler may be transported great distances from their source.

(b) Dustfall

Dustfall comprises the larger size particleswhich settle out of the air due to the influence of gravity. It is measured by exposing open cylinders of specified dimensions for a period of 30 days. The total deposit in the cylinder is weighed. The

measured values include particulate matter which has dropped into the container (dry deposit) as well as that which has been scavenged by precipitation that has fallen into the container over the month. Dustfall levels are normally highest in the areas adjacent to industries and in such areas the dry deposit exceeds that which arrives in the precipitation. In practice the standard unit of measurement for dustfall is in tons per square mile per 30 days.

(c) Lead and Other Heavy Metals

The concentrations of lead and other heavy metals in the particulate matter collected by the high-volume and the dustfall samplers are obtained by atomic absorption analysis. The units of measurements are in micrograms per cubic metre for suspended particulate and in tons per square mile per 30 days for the levels contained in the dustfall.

(d) Sulphur Dioxide

Depending on the size and type of industry, sulphur dioxide may be of interest in areas surrounding lead smelting plants. Concentrations are obtained by operating continuous automated analysers which record the data on charts. Measurements are normally given in the units of parts per million parts of air by volume.

3. Canada Metals Company

(a) History of Monitoring

Figure 1 attached shows the air monitoring station locations and the type of samplers exposed in the vicinity of Canada Metals

Company, Toronto.

Measurements of total dustfall in the area date back to 1969 for the station #31019 at 661 Eastern Avenue located to the west of Canada Metals. Measurements of the lead content in the dustfall at this location began in 1971. Additional dustfall samplers were installed during early 1973 at stations #31059, #31060 and #31061.

A high-volume sampler was located at station #31045 Bruce Public School some 400 feet north of the Canada Metals property line. While the early measurements of lead in the suspended particulate matter measured at the Bruce Public School were determined to be meeting Ontario's criterion for desirable air, i.e. 15 ug/m^3 for 24 hours except for one occasion the lead in dustfall measured in this area was determined to be 10 times the normal urban lead in dustfall but well below the measurements being simultaneously obtained in the vicinity of Toronto Refiners. With continuous low readings of lead at the school, the survey was terminated at that location in October 1972. In April 1973 the high-volume sampler was installed at station #31058 on Line Belt property and in October 1973 high-volume sampling for suspended particulate matter was reinitiated at station #31045 Bruce Public School.

Data for continuous monitoring for sulphur dioxide has been carried out at Station #31016, 1 Leslie Street, by Ontario Hydro from 1969 until August 1973. The data which was made available to the Air Management Branch was being obtained to

determine the influence of their Hearn Generating Station and the abatement measures which were taken in 1971.

A summary of all the air quality data obtained in the vicinity of Canada Metals to date is given in Appendix 1. Included are some measurements of cadmium, zinc and copper obtained for a brief period at the Bruce Public School. All the measurements easily met the Ontario proposed criterion, 2 ug/m^3, for cadmium. Zinc and copper are considered inert.

(b) Interpretation of Results

The levels of total suspended particulate matter, dustfall and lead content in the area adjacent to Canada Metals well exceed Ontario's desirable ambient air criteria. The decrease in levels with distance from the plant in the case of lead in dustfall, (see Figure 2), and the tabulation of the wind data with respect to suspended particulate matter observations indicate that the Canada Metals plant is the principal contributor to these measured pollutants.

Lead values in the suspended particulate matter samples obtained at station #31058 were up to almost five times our present criterion of 15 ug/m^3 and exceed our proposed criterion of 5 ug/m^3 whenever the winds are blowing in the direction from the plant towards the sampler during a portion of the day. There is only one day that 5 ug/m^3 was exceeded and the wind direction from the plant was for less than 6 hours. Reentrainment, automotive sources and other possible sources of lead such as the power

generating station and incinerator are only small contributors in comparison to Canada Metals. The normal seasonal trend in total dustfall, (spring maximums), has been obliterated by the strong influence of the industrial emissions in the area.

The summary of sulphur dioxide levels over the past years shows a marked improvement especially with completion of the abatement of the Hearn Generating Station in late 1971. The power plant was the principal contributor of this contaminant when sulphur dioxide concentrations frequently exceeded Ontario's criteria. During the one occasion in 1973 that the criteria were exceeded the winds were blowing toward the sampler from the Canada Metals plant.

4. Toronto Refiners and Smelters

(a) History of Monitoring

Figure 3 attached shows the air quality monitoring stations established by the Air Management Branch in the vicinity of Toronto Refiners and Smelters. Air quality sampling was initiated with the installation of a high-volume sampler at B.F. Goodrich Store, 35 Bathurst Street, in September 1970. This location is about 250 feet northeast of Toronto Refiners and Smelters property boundary. Seventeen measurements were taken over a three-month period. All readings were well below Ontario's criterion of 15 ug/m^3, the maximum being 5.2 ug/m^3, and the survey was terminated on November 20, 1973. The average levels were somewhat higher than that recorded in downtown Toronto

indicating a small but non-automotive source of lead in the area.

Dustfall samplers were installed at stations #31050 and #31051 on December 1, 1972, and at stations #31053, #31054, #31055 and #31056 on April 1, 1973. Also in April 1973 the high-volume sampler was reinstalled at 35 Bathurst Street, Station #31018, and an additional high-volume sampler was located east of the plant on Tecumseh Street, Station #31057. This location is about 100 feet from the plant property boundary.

Appendix 2 provides the complete air quality data obtained to date in the vicinity of the Toronto Refiners and Smelters.

(b) Interpretation of Data

The total suspended particulate matter and dustfall levels well exceed Ontario's criteria for these contaminants. The excessive values are similar to those which are obtained in areas adjacent to industrial activity such as that carried out at this plant. The problem is accentuated in the vicinity of Toronto Refiners and Smelters due to the proximity of residences located a few feet from the property line. This allows for public access and measurements to be taken much closer to this source than at other plants of this nature. The dustfall measurements and lead content are highest near Toronto Refiners and Smelters than at any other plant surveyed. Concentrations decrease with distance, (see Figure 4), from the source implicating

the activity at the plant as the principal source. The trend in data shows little contribution from the present emission controlled operation of the battery crusher. Concentrations are very high during the period when the battery crusher was not in operation as well as when the battery crusher is allowed to be operated with controlled emissions. The peak reading of dustfall was 102 tons per square mile per month during March 1973 when the battery crusher was shut down. High concentrations of 5.82 tons/square mile/month of lead in dustfall were recorded in April when the battery crusher was not operating as well as in September, 6.67 tons/square mile/month, when the crusher was operating but controlled. This implies that other activity must be responsible for the high dustfall levels.

The lead content in suspended particulate matter measurements exceeded 15 ug/m^3 on 2 days with the peak reading of 25 ug/m^3. The levels are well below the measurements near Canada Metals. On both days that the criterion was exceeded, winds were from the direction of the plant to the sampler. Concentrations of lead exceeded 5 ug/m^3 on 35 days, 10 of which the winds were predominantly not blowing in the direction from the plant. The situation is quite different from that of Canada Metals where on only one day did this occur. The evidence indicates other off-property sources as contributors. A visual inspection during a dry, windy day indicated a considerable amount of dust in the air emanating from vacant lots north and south of the plant.

Reentrainment is a likely contributor to the dustfall and suspended particulate matter measurements. A comparison of winter vs. summer measurements will indicate the degree of this contribution.

Concentrations of suspended particulate matter and lead content show little relationship with the present emission controlled battery crushing operation. Measurements were as high when this operation was shut down as when it is operating but under control.

5. Conclusions

(a) Total suspended particulate matter, lead concentrations and dustfall exceed Ontario's criteria for these contaminants in the vicinity of both Canada Metals and Toronto Refiners and Smelters. Data indicate that the lead in the suspended particulate matter, that is the smaller sized particles are the principal problem in the vicinity of Canada Metals whereas the larger particles,or that which becomes collected as dustfall, are the main problem in the vicinity of Toronto Refiners and Smelters.

(b) Reentrainment of dust from both off and on the property of Toronto Refiners and Smelters contributes greatly to the levels of lead measured in the vicinity of that plant. The high concentrations in the dustfall measured at close proximity to the plant indicate a low elevation source. This implies that the transport and handling of materials produce a major contribution to the levels measured.

(c) The relationship of concentrations of lead in dustfall vs. distances from the plants as well as the measurements of lead in suspended particulate matter obtained near major traffic arteries elsewhere in Metropolitan Toronto, (see Table 1), indicate the industries to be the prime sources with minor contributions in comparison attributed to automotive traffic in the area.

(d) Sulphur dioxide levels in the vicinity of Canada Metals are presently very close to meeting Ontario's criteria.

6. Extended Survey Plans

Plans are underway to obtain size distribution measurements of the particles by means of Andersen impactors, bromine/lead ratios to distinguish more exactly the automotive sources of lead and measurements of cadmium and arsenic in the vicinity of both plants. An additional high-volume sampler was installed in November 200 feet north of Canada Metals for which laboratory results are not as yet available.

DECEMBER 1973.

TABLE 1

SUMMARY OF SUSPENDED PARTICULATE MATTER MEASUREMENTS

Station Number	Location	Geom. Mean Total Suspended Particulate Matter (ug/m^3)	Geom. Mean Lead (ug/m^3)	Maximum Lead Conc. (ug/m^3)	Percentage of Days Lead Conc. Exceeds 5 ug/m^3	Percentage of Days Lead Conc. Exceeds 15 ug/m^3
31045	Bruce Public School - 400 feet from C.M.	99	1.62	18.0	6.6	1.1
31058	660 Eastern 50 Feet from C.M.	135	6.74	74.4	53.6	32.1
31018	35 Bathurst 250 feet from T.R.	143	3.12	14.34	23.2	0
31057	Tecumseh 100 feet from T.R.	143	3.62	25.5	36.7	3.3
35033	Control Site Evans Avenue 200 feet from Q.E.	95	2.20	7.5	5.1	0

C.M. - Canada Metals

T.R. - Toronto Refiners

Q.E. - Queen Elizabeth Highway

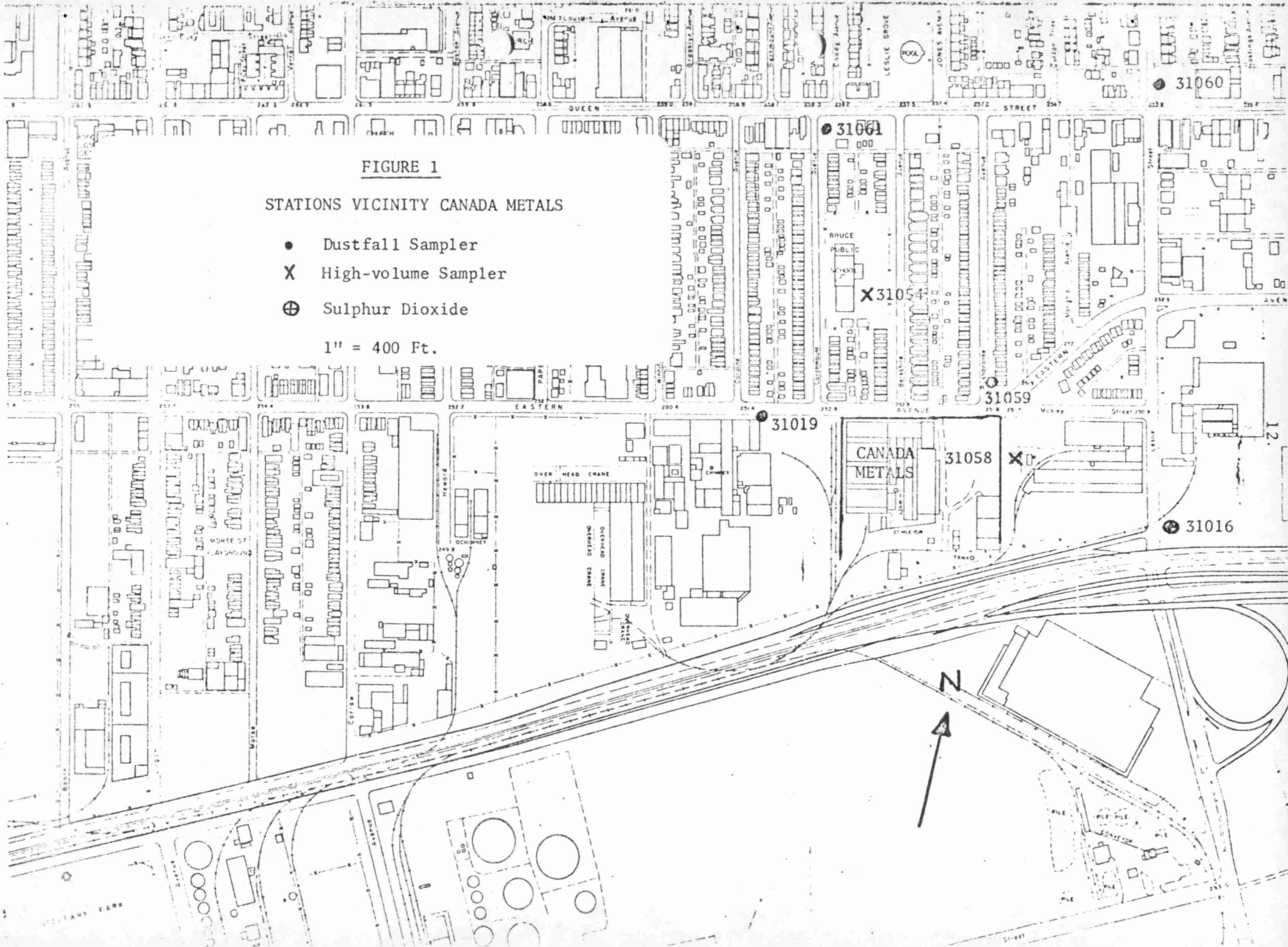
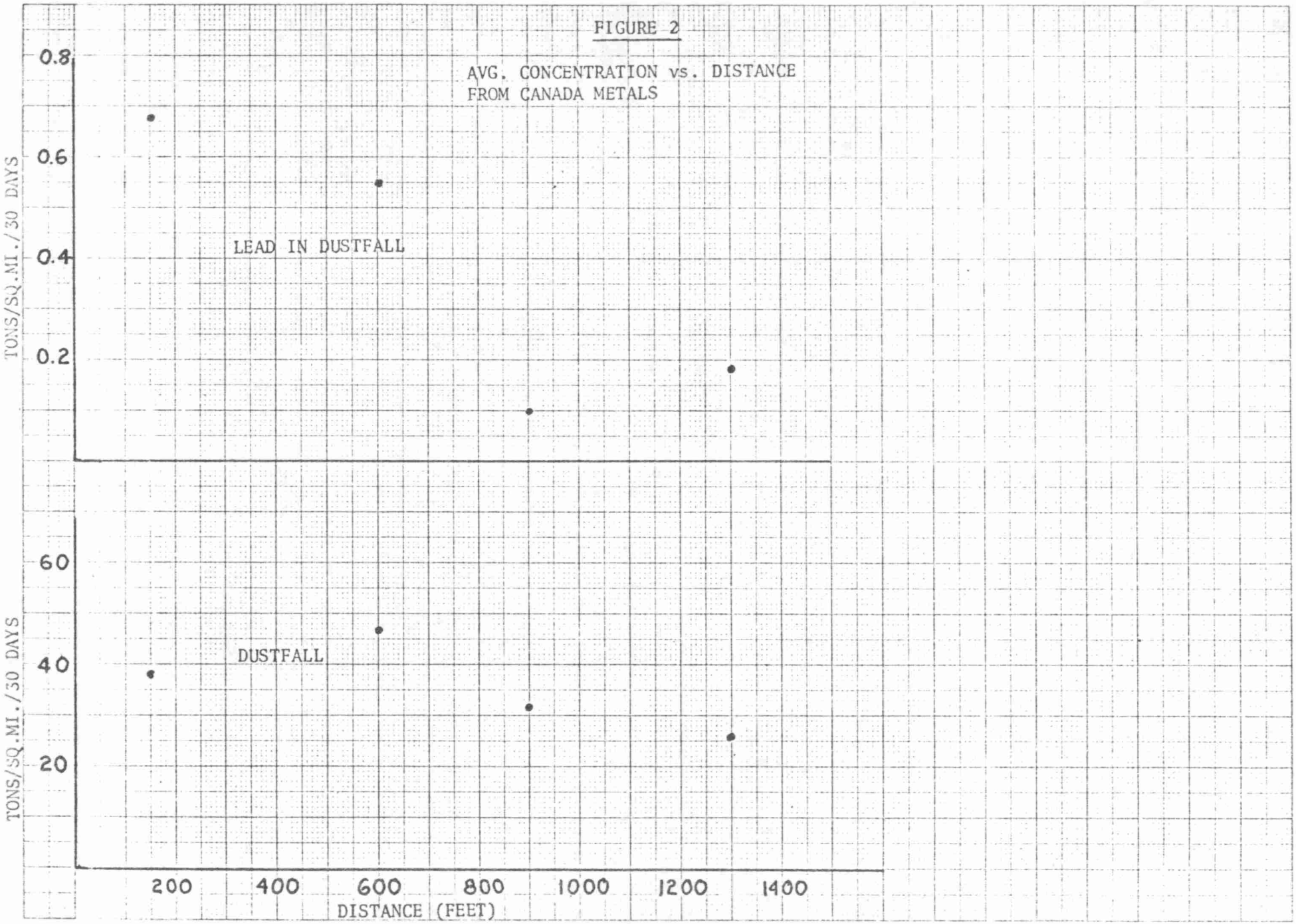


FIGURE 1
STATIONS VICINITY CANADA METALS
• Dustfall Sampler
X High-volume Sampler
⊕ Sulphur Dioxide
1" = 400 Ft.
31060
31061
31054
31059
31019
CANADA METALS
31058
31016
N
QUEEN
STREET
EASTERN
AVENUE
OVER HEAD CRANE
CHIMNEY
OVERHEAD CRANE
PILE

K&E 10 X 10 TO THE CENTIMETER 18 X 25 CM
KEUFFEL & ESSER CO. MADE IN U.S.A.

FIGURE 2

AVG. CONCENTRATION vs. DISTANCE
FROM CANADA METALS



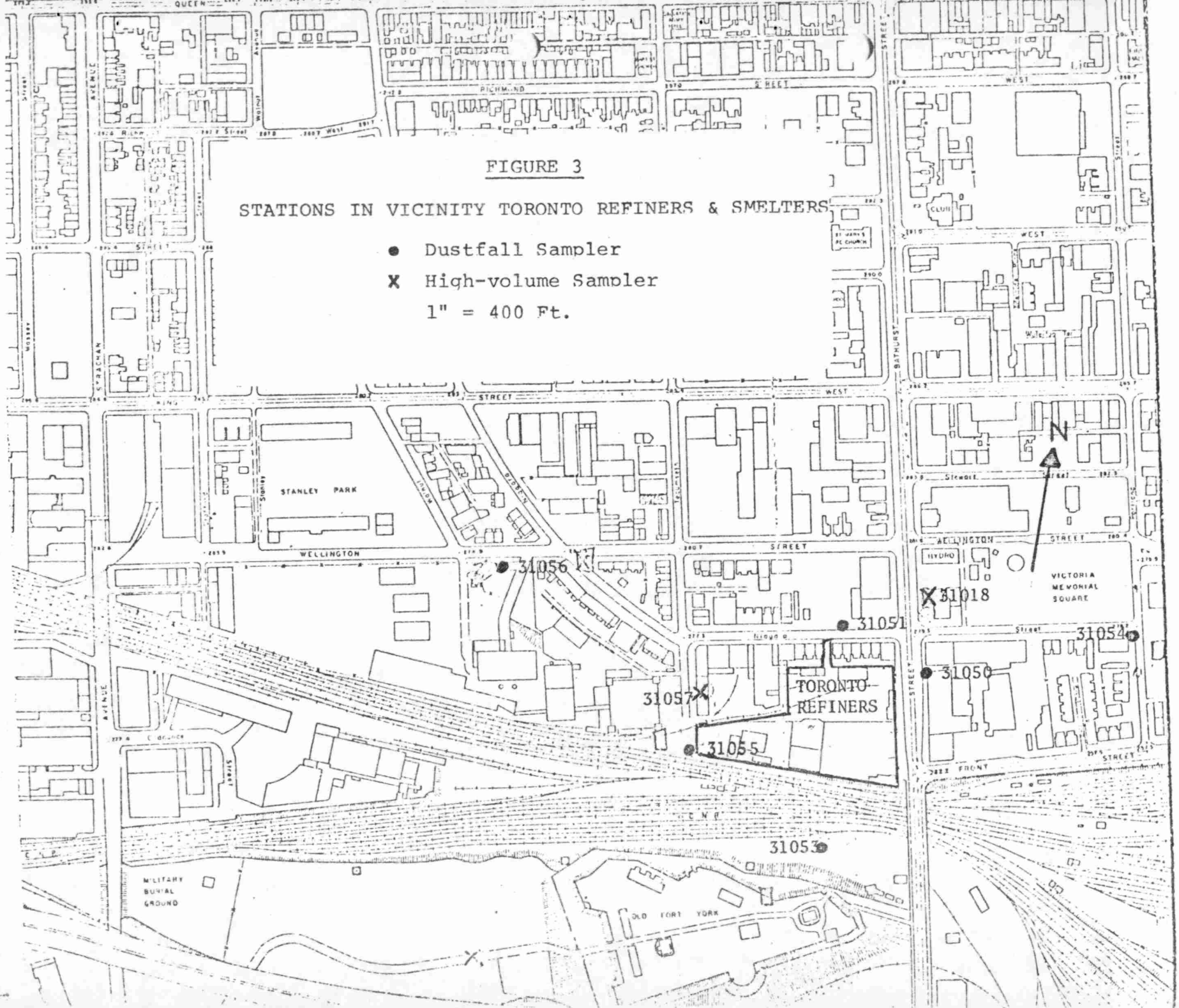
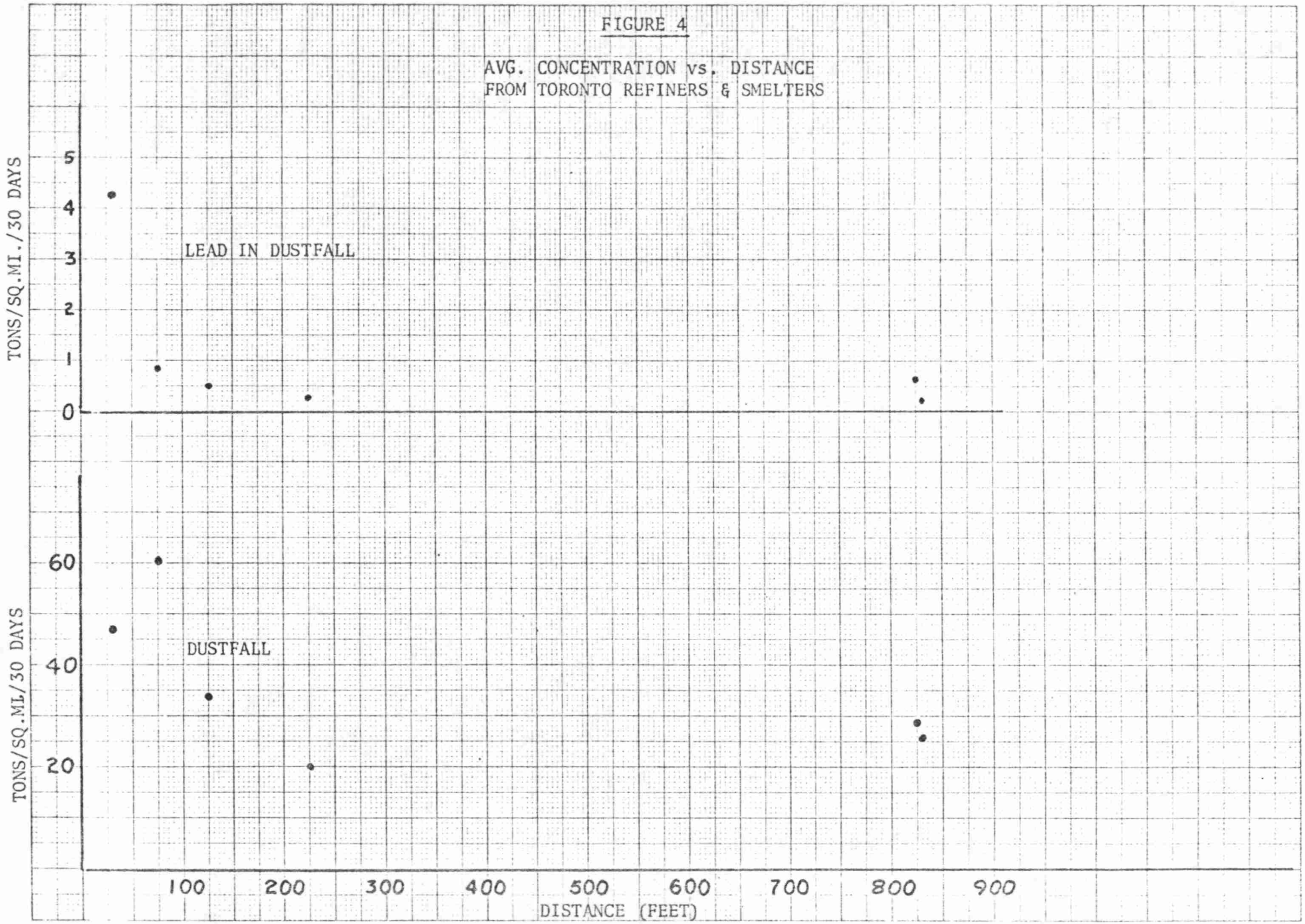


FIGURE 3
STATIONS IN VICINITY TORONTO REFINERS & SMELTERS
● Dustfall Sampler
X High-volume Sampler
1" = 400 Ft.
31056
31051
31018
31054
31050
31057
31055
31053
TORONTO REFINERS
STANLEY PARK
VICTORIA MEMORIAL SQUARE
MILITARY BURIAL GROUND
OLD FORT YORK
WELLINGTON
STREET
BATHURST
SPADINA
AVENUE
C N R
N

FIGURE 4

AVG. CONCENTRATION vs. DISTANCE
FROM TORONTO REFINERS & SMELTERS



APPENDIX 1

AIR QUALITY IN THE VICINITY OF CANADA METALS

STATION #31045 - BRUCE PUBLIC SCHOOL

Date	SUSPENDED PARTICULATE MATTER (ug/m^3)					METEOROLOGICAL DATA			
	Total	Lead	Zinc	Cadmium	Copper	Avg. Wind Speed (mph)	No. of Hrs. in Direction from Plant	No. of Hours Calm	Precipitation (Inches)
1972									
Jan. 20	77	3.77	0	0.014	-	8.7	5	0	.52
21	68	1.41	0	0.002	-	11.0	8	0	.01
24	84	1.16	2.2	0.011	-	11.8	0	2	.20
25	158	0.9	2.2	0.014	-	29.9	0	0	.02
27	87	0.95	2.2	0.001	-	13.6	0	0	.16
28	68	0.77	1.47	0.002	-	13.9	0	0	Tr.
31	102	1.0	-	0.006	0.39	15.9	0	0	Tr.
Feb. 1	108	1.4	0.23	0.004	0.09	6.6	1	2	0
	48	0.5	3.35	0.001	0.10	27.4	0	0	.07
10	64	1.3	0.1	0.008	0.09	6.1	0	0	0
11	148	1.8	0.18	0.002	0.10	8.0	0	0	Tr.
14	87	0.7	1.61	0.002	0.17	14.3	2	0	Tr.
15	83	5.3*	2.11	0.004	0.19	13.9	5	1	.12
17	147	1.3	1.70	0.034	0.17	13.9	15	0	0
18	103	18.0**	1.10	0.0034	0.21	7.8	20	0	.46
21	107	1.4	1.77	0.003	0.14	14.1	5	2	.03
22	66	1.0	-	0.001	0.18	14.0	0	0	.02
24	75	1.6	-	0.001	0.13	5.5	0	1	Tr.
25	114	1.8	1.62	0.002	0.13	7.9	2	2	.08
28	89	1.6	-	0.003	0.11	8.3	6	0	.02
29	116	3.5	0.03	0.01	0.22	6.6	4	1	.01
March 2	35	0.7	4.87	-	0.22	8.8	0	1	.21
3	37	0.9	-	-	0.16	7.5	0	0	Tr.
6	63	3.73	0.43	0.009	-	10.6	6	0	.31
9	56	1.02	0	0.011	-	7.8	0	0	Tr.
10	26	0.31	0	0.018	-	7.3	0	0	0
13	98	0.94	2.22	0.008	-	20.3	0	0	.50
14	86	1.07	0.94	0.055	-	14.0	2	0	.61
16	93	1.71	1.67	0.008	-	7.7	1	1	.40
17	99	2.16	1.88	0.011	-	7.2	0	0	Tr.
20	103	1.56	0.40	0.007	-	4.1	14	1	0
21	127	0.81	2.40	0.02	-	15.5	0	0	.47
23	23	0.41	1.65	0.003	-	13.0	0	0	.04
24	67	0.79	2.52	0.015	-	13.8	0	0	Tr.
27	92	0.58	0	0.006	-	10.0	0	0	0
June 13	165	1.5	0	0.11	-	8.3	0	0	0
15	204	1.4	0	0.008	-	8.5	3	0	Tr.
16	110	1.2	0	0.005	-	9.3	4	0	0
19	180	1.33	0	0.002	-	8.4	1	0	0
20	176	4.3	0	0.025	-	6.1	13	2	.03
22	33	0.5	0	0.001	-	16.7	0	0	.31
25	61	1.0	0	0.004	-	15.5	0	0	.12
26	166	6.0*	0	0.022	-	2.3	8	8	.05
27	251	4.1	0	0.087	-	4.3	4	0	Tr.
29	268	4.9	0	0.031	-	11.7	0	1	.77
30	284	6.9*	0.6	0.045	-	8.9	0	0	Tr.

* Exceeds 5 ug/m^3

** Exceeds 15 ug/m^3

APPENDIX 1

AIR QUALITY IN THE VICINITY OF CANADA METALS

STATION #31045 - BRUCE PUBLIC SCHOOL

	SUSPENDED PARTICULATE MATTER (ug/m^3)					METEOROLOGICAL DATA			
Date	Total	Lead	Zinc	Cadmium	Copper	Avg. Wind Speed (mph)	No. of Hrs. in Direction from Plant	No. of Hours Calm	Precipitation (Inches)
1972									
July 14	132	4.8	0	0.013	-	5.8	5	0	.28
20	133	2.5	0	0.004	-	3.5	5	5	0
21	192	1.6	0	0	-	9.0	0	0	0
24	128	1.0	0	0	-	9.4	1	0	0
25	113	1.3	0	0	-	11.3	0	0	Tr.
27	110	2.3	0	0	-	6.0	5	0	0
28	122	2.6	0	0.003	-	4.5	5	0	0
31	197	7.3*	0	0.007	-	5.0	14	1	0
Aug.	197	3.6	0	0.007	-	4.4	6	3	.79
3	118	1.5	0	0.001	-	9.1	0	0	.01
31	233	8.8*	1.7	0.030	-	5.1	4	5	0
Sept. 1	193	4.8	0	0.004	-	4.6	14	1	0
4	72	1.6	0	0	-	7.3	3	0	0
7	206	2.2	0	0.009	-	6.6	14	1	.73
8	134	2.3	0	0.007	-	6.5	6	0	.51
11	189	2.5	0	0.013	-	6.7	7	1	0
12	174	4.3	0	0.009	-	3.3	6	4	Tr.
14	80	1.2	0	0	-	9.7	0	0	0
15	248	3.7	0	0.019	-	10.2	2	0	0
18	114	1.4	0	0.006	-	9.2	0	0	.30
19	74	2.2	0	0.005	-	8.5	3	1	0
21	111	1.9	0	0.003	-	7.3	17	0	0
22	112	1.8	0	0.001	-	7.9	0	0	0
3	170	3.0	0	0.014	-	7.3	2	0	.28
6	208	3.9	-	0.023	-	7.5	2	2	.06
28	67	0.8	-	0.013	-	13.4	3	0	0
29	135	2.9	-	0.035	-	7.6	7	1	1.02
Oct. 2	150	2.4	-	0.011	-	6.3	14	0	0
3	186	4.7	-	0.027	-	6.2	2	1	0
5	165	3.3	-	0.015	-	7.5	6	0	0
6	93	3.1	-	0.010	-	4.8	4	1	.69
TERMINATED									
1973									
Oct. 28	23	0.01	-	-	-	31.3	0	0	1.5
29	26	0.61	-	-	-	28.0	0	0	1.6
30	27	2.57	-	-	-	10.6	1	0	.5
31	73	1.51	-	-	-	8.6	9	0	.3
Nov. 1	56	1.05	-	-	-	22.6	2	0	.3
2	88	2.01	-	-	-	12.9	0	0	.2
3	34	0.88	-	-	-	18.2	0	0	0

* Exceeds 5 ug/m^3

APPENDIX 1

AIR QUALITY IN THE VICINITY OF CANADA METALS

STATION #31045 - BRUCE PUBLIC SCHOOL

Date	SUSPENDED PARTICULATE MATTER (ug/m^3)					METEOROLOGICAL DATA			
	Total	Lead	Zinc	Cadmium	Copper	Avg. Wind Speed (mph)	No. of Hrs. in Direction from Plant	No. of Hours Calm	Precipitation (Inches
1973									
Nov. 6	75	0.91	-	-	-	20.9	0	0	0
7	120	1.65	-	-	-	13.0	0	0	0
8	128	0.78	-	-	-	21.1	0	0	0
9	61	1.04	-	-	-	13.7	0	0	0
10	42	0.78	-	-	-	10.9	0	0	0
11	102	1.48	-	-	-	16.0	0	0	0
12	142	1.11	-	-	-	17.3	0	0	0

APPENDIX 1

AIR QUALITY IN THE VICINITY OF CANADA METALS

STATION #31058 - 660 EASTERN AVENUE

Date	SUSPENDED PARTICULATE MATTER (ug/m3)		METEOROLOGICAL DATA			
	TSP	Lead	Avg. Wind Speed (mph)	No. of Hrs. in Direction from Plant	No. of Hours Calm	Precipitation (Inches)
1973						
April 15	195	0.34	8.9	9	1	0
23	232	1.65	11.8	21	0	0
27	29	1.35	18.3	0	0	.8
May 1	68	4.44	12.8	19	0	.3
5	90	2.45	16.3	12	0	0
9	224	26.1**	6.7	15	2	0
13	179	41.0**	12.1	24	0	0
17	155	4.99	9.6	20	0	0
21	86	1.23	12.4	3	0	0
25	273	1.42	14.0	0	0	.3
June 2	76	1.87	9.1	0	0	0
6	212	51.12**	9.2	18	3	1
10	165	9.79*	4.9	18	1	0
14	203	5.30*	9.8	9	0	0
18	106	1.92	6.5	0	0	0
22	299	45.92**	4.1	15	6	4
26	119	7.94*	8.5	6	1	0
30	196	49.23**	5.2	19	4	0
July 4	150	36.1**	5.8	14	3	.2
12	249	30.3**	8.2	17	1	.1
16	125	3.87	5.2	11	3	0
20	356	14.6*	3.2	7	4	0
24	33	1.12	9.0	0	0	.4
28	128	21.5**	8.8	20	1	.1
Aug. 1	101	1.6	7.1	0	0	0
5	114	4.43	5.8	21	0	0
9	323	71.4**	5.9	18	4	0
13	274	74.4**	4.0	14	4	0
17	134	3.9	6.0	0	2	.2
21	232	17.6**	11.5	3	0	0
25	140	6.0*	3.1	6	3	0
29	145	42.7**	6.7	23	0	0
Sept. 6	204	11.9*	14.8	19	0	0
10	219	29.9**	7.5	15	2	0
14	148	2.5	9.6	0	3	0
18	87	2.9	10.9	2	0	0
22	INVALID	-	10.7	13	0	.7
30	60	2.7	7.1	0	0	0

*Exceeds 5 ug/m^3

**Exceeds 15 ug/m^3

APPENDIX 1

AIR QUALITY IN THE VICINITY OF CANADA METALS

STATION # 31058 - 660 EASTERN AVENUE

Date	SUSPENDED PARTICULATE MATTER (ug/m^3)		METEOROLOGICAL DATA			
	TSP	Lead	Avg. Wind Speed (mph)	No. of Hrs. in Direction from Plant	No. of Hours Calm	Precipitation (Inches)
1973						
Oct. 4	145	4.7	7.5	9	0	.1
8	47	0.72	11.3	0	0	0
13	199	32.0**	14.1	23	0	.3
16	196	3.33	18.2	24	0	0
20	55	1.02	10.7	1	0	0
24	288	7.52*	5.5	10	0	0
28	INVALID	-	31.3	0	0	1.5
29	23	.37	28.0	0	0	1.6
31	126	53.5**	8.6	21	1	.3
Nov. 1	93	5.15*	22.6	23	0	.3
2	109	5.01*	12.9	17	0	.2
3	40	1.24	18.2	19	0	0
6	172	5.12*	20.9	24	0	0
7	182	7.41*	13.0	24	0	0
8	246	14.61*	21.1	24	0	0
9	105	2.97	13.7	6	0	0
10	71	3.41	10.9	10	0	0
11	115	18.6**	16.0	24	0	0
12	261	50.8**	17.3	24	0	0
13	276	31.4**	11.0	23	1	0

* Exceeds 5 ug/m^3

** Exceeds 15 ug/m^3

PO[illegible]TANT: DUSTFALL

TONS/SQ.MI./30 DAYS

Year	Station	Location	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean
1972	31050	Bathurst/Niagara												35	
1973	31050	Bathurst/Niagara	68	58	102	M	56	64	57	55	77	58			
1972	31051	Niagara Street												26	
1973	31051	Niagara Street	33	26	39	54	37	34	34	26	30	22			
1973	31053	Cabin D, CNR				24	25	17	20	15	19	M			
1973	31054	Portland/Wellington				N.D.	31	24	27	32	23	19			
1973	31055	Tecumseh Street				71	64	36	41	32	45	43			
1973	31056	Wellington/Niagara				31	31	32	28	23	31	M			

P UTANT: LEAD IN DUSTFALL

TONS/SQ.MI./30 DAYS

Year	Station	Location	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean
1971	31019	661 Eastern		0.44	0.56	0.55	M	M	M	0.58	0.57	0.49	0.73	0.36	0.53
1972	31019	661 Eastern	0.29	0.29	0.21		0.74	0.81	0.45	0.78	0.62	0.52	0.46	0.14	0.49
1973	31019	661 Eastern	0.40	0.48	0.57	0.55	0.45	0.71	0.64	0.43	0.50	0.57			
1973	31059	Rushbrooke/Eastern				0.56	0.77	0.73	1.16	0.56	0.19	0.78			
1973	31060	Leslie/Queen				0.11	0.12	0.16	0.15	0.19	0.45	0.17			
1973	31061	Larchmount/Queen				0.09	0.06	0.10	0.13	0.08	0.13	M			

SUMMARY OF SO_2 DATA FOR STATION #31016 AT 1 LESLIE STREET

Year	Arithmetic Mean ppm	Maximum 1 Hour ppm	Maximum 24-Hour ppm	Number of Times Above Ontario Criteria		
				1 Hour	24-Hour	1 Year
1969	.063	1.03	0.24	39	34	1
1970	.052	1.23	0.51	39	14	1
1971	.042	1.01	0.22	29	8	1
1972	.031	0.23	0.10	NIL	NIL	1
1973 (8 months)	.028	0.27	0.11	1	1	1

Ontario Criteria for SO_2:

1 Hour - 0.25 ppm

24-Hour - 0.10 ppm

1 Year - 0.02 ppm

AIR QUALITY IN THE VICINITY OF TORONTO REFINERS

STATION #31057 - TECUMSEH STREET

Date	SUSPENDED PARTICULATE MATTER (ug/m^3) TSP	Lead	METEOROLOGICAL DATA Avg. Wind Speed (mph)	No. of Hrs. in Direction from Plant	No. of Hours Calm	Precipitation (Inches)
1973						
April 11	94	2.68	18.6	0	0	0
15	184	6.97*	8.9	14	1	0
19	260	0.66	12.1	24	0	.04
27	130	0.35	18.3	18	0	.77
May 1	154	7.46*	12.8	24	0	.29
9	184	6.84*	6.7	6	2	.02
13	45	0.60	12.1	0	0	0
17	110	1.33	9.6	0	0	Tr.
21	90	2.45	12.4	0	0	0
25	174	8.54*	14.0	24	0	.28
29	143	2.02	10.7	0	0	Tr.
June 2	127	0.86	9.1	22	0	0
6	150	2.10	9.2	0	3	.05
10	129	1.30	4.9	1	1	0
14	120	2.03	9.8	0	0	0
18	138	14.4*	6.5	20	0	0
22	197	4.9	4.1	0	6	.40
26	287	25.5**	8.5	17	1	Tr.
30	138	3.8	5.2	0	4	.02
July 4	229	9.35*	5.8	3	3	.16
8	193	2.47	7.2	0	0	0
12	190	1.90	8.2	0	1	.13
16	173	8.11*	3.2	4	3	0
20	298	4.82	3.2	5	4	0
21	124	2.84		14	0	0
23	159	5.26*	7.6	24	0	0
24	219	8.91*	9.0	24	0	.38
25	258	12.3 *	3.7	14	7	.13
26	170	4.16	5.9	0	4	.02
27	262	2.63	13.9	0	0	.62
28	133	2.42	8.8	0	1	.14
30	317	7.78*	4.8	11	3	0
Aug. 1	167	4.25	7.1	22	0	0
2	182	3.02	4.7	3	3	.05
6	231	2.07	6.9	0	1	0
7	66	0.92	4.9	0	1	0
11	101	2.40	8.2	0	4	Tr.
13	144	3.56	4.0	0	4	0
14	58	1.74	4.7	17	5	0
15	140	6.21*	6.3	4	3	0
16	158	14.5*	3.5	14	5	0

*Exceeds 5 ug/m^3

**Exceeds 15 ug/m^3

APPENDIX 2

AIR QUALITY IN THE VICINITY OF TORONTO REFINERS

STATION #31057 - TECUMSEH STREET

Date	SUSPENDED PARTICULATE MATTER (ug/m^3) TSP	Lead	METEOROLOGICAL DATA Avg. Wind Speed (mph)	No. of Hrs. in Direction from Plant	No. of Hours Calm	Precipitation (Inches)
1973						
Aug. 17	151	7.77*	6.0	16	2	.15
18	96	5.10*	6.3	21	0	0
21	80	4.46	11.5	2	0	Tr.
25	141	1.70	3.1	10	3	0
29	230	2.41	6.7	0	0	0
Sept. 2	210	3.94	4.6	0	2	0
6	147	1.46	14.8	0	0	0
10	195	3.87	7.5	1	2	0
14	144	6.70*	9.6	21	3	0
18	76	2.88	10.9	1	0	0
22	100	7.31*	10.7	9	0	.69
26	201	8.80*	8.9	23	0	0
Oct. 12	228	11.74*	4.8	11	8	Tr.
16	65	10.82*	17.7	0	0	.01
20	80	2.27	10.7	1	0	0
24	323	22.64**	5.5	13	0	0
28	47	3.72	31.3	24	0	1.73
Nov. 2	94	1.72	12.9	0	0	0.2
9	58	0.82	13.7	0	0	0

* Exceeds 5 ug/m^3

** Exceeds 15 ug/m^3

AIR QUALITY IN THE VICINITY OF TORONTO REFINERS

STATION # 31018 - 35 BATHURST STREET

Date	SUSPENDED PARTICULATE MATTER (ug/m^3)		METEOROLOGICAL DATA			
	TSP	Lead	Avg. Wind Speed (mph)	No. of Hrs. in Direction from Plant	No. of Hours Calm	Precipitation (Inches)
1973						
Apr. 19	223	2.43	12.1	0	0	.04
27	58	0.33	18.3	0	0	.77
May 1	127	3.27	12.8	0	0	.29
5	92	1.11	16.3	0	0	0
9	229	7.72*	6.7	9	2	.02
13	56	0.89	12.1	1	0	0
17	91	3.12	9.6	6	0	Tr.
21	93	1.04	12.4	0	0	0
29	183	4.65	10.7	7	0	Tr.
June 2	104	1.88	9.1	0	0	0
6	201	6.87*	4.9	7	3	.05
10	139	2.18	4.9	3	1	0
14	167	4.16	9.8	3	0	0
18	117	1.87	6.5	0	0	0
22	76	9.03*	4.1	3	6	.40
26	210	2.74	8.5	1	1	Tr.
30	144	3.12	5.2	11	4	.02
July 4	219	5.68*	5.8	4	3	.16
8	214	12.3*	7.2	7	0	0
12	156	3.15	8.2	2	1	.13
16	213	3.93	3.2	9	3	0
20	267	4.95	5.1	1	4	0
21	105	1.96	7.6	0	0	0
24	146	1.88	9.0	0	0	.38
25	169	2.42	3.7	1	7	.13
26	245	3.49	5.9	8	4	.02
27	181	4.93	13.9	12	0	.62
28	101	1.64	8.8	5	1	.14
30	188	2.41	4.8	1	3	0
31	232	3.44	4.1	3	3	1.17
Aug. 1	135	1.81	7.0	0	0	0
2	201	3.53	4.7	4	3	.05
3	159	2.74	6.9	7	1	0
7	-	6.76*	4.9	8	1	0
9	217	6.72*	5.9	5	4	.01
10	184	4.27	5.0	4	2	Tr.
11	87	3.80	8.2	14	4	Tr.
13	186	3.46	4.0	5	4	0
14	222	3.20	4.7	0	5	0
15	108	1.62	6.3	0	3	0
16	165	2.45	3.5	0	5	0

*Exceeds 5 ug/m^3

APPENDIX 2

AIR QUALITY IN THE VICINITY OF TORONTO REFINERS

STATION # 31018 - 35 BATHURST STREET

Date	SUSPENDED PARTICULATE MATTER (ug/m³) TSP	Lead	METEOROLOGICAL DATA Avg. Wind Speed (mph)	No. of Hrs. in Direction from Plant	No. of Hours Calm	Precipitation (Inches)
1973						
Aug.17	150	2.68	6.0	0	2	.15
18	62	1.28	6.3	0	0	0
21	115	1.74	11.9	0	0	Tr.
25	164	3.00	3.1	0	3	0
29	247	7.08*	8.6	6	0	0
Sept.2	193	-	4.6	8	2	0
6	158	14.34*	14.8	0	0	0
10	157	6.22*	7.5	7	2	0
14	97	1.25	9.6	0	3	0
18	95	2.05	10.9	0	0	0
22	107	1.63	10.7	2	0	.69
26	168	4.90	8.9	0	0	0
Oct.12	204	11.4 *	5.1	1	7	Tr.
16	63	0.71	17.9	0	0	.01
20	48	10.81*	10.6	0	0	0
24	315	9.15*	5.5	3	0	0

PC UTANT: DUSTFALL

TONS/SQ.MI/30 DAYS

Year	Station	Location	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean
1969	31019	661 Eastern	7	72	57	58	64	62	41	64	26	52	58	31	49
1970	31019	661 Eastern	40	88	67	72	50	57	68	51	44	45	58	36	56
1971	31019	661 Eastern	44	26	47	106	64	52	50	35	52	35	42	36	49
1972	31019	661 Eastern	34	32	34	58	51	66	62	58	55	51	37	132	56
1973	31019	661 Eastern	49	35	46	47	58	66	50	38	39	28			
1973	31059	Rushbrooke/Eastern				54	58	43	32	25	30	23			
1973	31060	Leslie/Queen				30	26	31	25	23	27	18			
1973	31061	Larchmount/Queen				30	35	26	22	20	26	M			

POL ANT: LEAD IN DUSTFALL

TONS/SQ.MI./30 DAYS

Year	Station	Location	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean
1972	31050	Bathurst/Niagara												0.89	
1973	31050	Bathurst/Niagara	3.11	0.97	0.93	M	M	0.75	0.82	0.68	1.27	1.06			
1972	31051	Niagara Street												0.17	
1973	31051	Niagara Street	0.23	0.20	0.24	0.26	0.43	0.71	0.74	0.64	0.66	0.30			
1973	31053	Cabin D, CNR				0.25	0.37	0.20	0.20	0.26	0.32	M			
1973	31054	Portland/Wellington				N.D.	0.12	0.10	0.12	0.15	0.32	0.11			
1973	31055	Tecumseh Street				5.82	2.49	5.05	2.37	3.57	6.67	3.76			
1973	31056	Wellington/Niagara				0.56	0.77	0.73	1.16	0.56	0.19	0.78			

SECTION 9

UNIVERSITY OF TORONTO

ENVIRONMENTAL SCIENCES

REPORTS

SECTION 9

UNIVERSITY OF TORONTO STUDY

The University of Toronto Environmental Sciences & Engineering Programme undertook studies of lead contamination in industrial areas of Toronto in the months May - September 1973 with attention being focused on the Canada Metal Company & Rotocast Limited & Toronto Refiners & Smelters Limited.

Canada Metal Study

Dustfall Measurements

Measurements were made of dustfall and lead in dustfall in the months June - September 1973 at one location. Data obtained from A.M.B. was integrated with this in the report. Total dustfall exceeded the provincial criterion at all samplers close to Canada Metal.

Hi-Volume Sampler-Suspended Lead Measurements

A Hi-Volume sampler was located at ground level approximately 300 feet North of the Canada Metal Plant. Measurements were made in the period May-August 1973. At no time did the mean monthly value reported exceed either the present or proposed standard for suspended lead particles. No wind data area reported.

The sampler was equipped with an Andersen particle sizing head and 7 runs were made in late October and early November. At no time did the lead loading exceed the proposed standard of 5 $\mu g/m^3$ but the highest readings were recorded when the wind was from the plant for a significant time.

Readings were low in the period that the plant was closed down under the Stop Order but winds were in general contrary to the plant and despite statements on the University Report no conclusions can be drawn.

The particle size range of the particulate catch was concentrated in the large particle ($>7\mu$ range) and the very small ranges ($<1.1\mu$) indicating both settleable particles and fine fume to be present.

Lead in Soil

The University took surface soil samples 0-2 cm at various locations around the Canada Metal Plant.

The data are very widely scattered due to non-duplication of samples but show a similar trend to Air Management Branch data and are of the same order of magnitude with a few exceptions.

Lead in Vegetation

Only explanatory samples were taken together with samples at 23 other locations so that no comparison with A.M.B. data can be made.

Lead in Human Blood & Hair

Data supplied by the M.O.H. for Metro Toronto showed an elevated mean blood lead compared to a control population with 6.5% of the total population at Canada Metal have levels in excess of 40 µg/100 mls and 22% of the children sampled under 14 having levels in excess of 40 µg/100 ml.

Based on a sample population of 14 children with high blood lead the University showed a correlation of lead in blood with lead in hair which was interpreted to be indicative of a steady lead intake since lead hair is known to lag behind blood lead so that large swings in blood lead levels are not inflected in hair lead.

The sample population on which this correlation was based was only 14 so that the conclusions may be in some doubt.

SUMMARY & REVIEWS OF BRANCH COMMENTS ON REPORT

The data obtained by the U. of T. are not greatly at variance with A.M.B. data. The data were obtained in a limited sampling monitoring program and show large standard deviations in data for soil lead, vegetation lead, dust-fall and suspended lead. The sample population for arithmetic means was small and in many cases of soil and vegetation sampling less than standard quantities of material were analyzed.

The use of Andersen sizing heads is a technique worthy of implementation by A.M.B. Based on the limited data it would seem unscientific to draw such hard conclusions regarding the extent and source of lead contamination.

A.M.B. data is much more complete except for particle sizing and yet, as indicated in this report, it is not yet possible to draw hard conclusions since the evidence is largely circumstantial. Preliminary A.M.B. conclusions, however, are not greatly different from the University of Toronto findings but our conclusions are drawn in recognition of defects in the presently available data and the need for an on-going sampling program to give a better insight into the situation.

Toronto Refiners Report

The University of Toronto Environmental Sciences group undertook a study of lead contamination in air, soil, vegetation and dustfall in the vicinity of Toronto Refiners & Smelters. The study was more comprehensive than at Canada Metal and included an extensive dustfall network, soil and vegetation sampling, hi-volume sampler with particle sizing and moss bags for determination of contamination rates. Some blood lead sampling data are also reported but the source is not given (the implication in the report is that the U. of T. arranged the sampling).

Dustfall Measurements

A network of 14 sampling sites was set up and readings were taken in the months May-September, 1973. Data from the 5 A.M.B. sites were also included in the report. There was no significant difference between AMB and U. of T. data from adjacent sites and the general indications regarding dustfall were similar to those from A.M.B. data.

The computation of a so-called 'deposition velocity' which was the ratio of the lead in dustfall to suspended lead concentration was agreed in meetings with the U. of T. to be merely a dimensional excercise and ignored so many variables such as particle size, wind and met. conditions as to be meaningless.

Hi-Volume Sampler - Suspended Lead Levels

Hi-Volume samplers were located at 2 locations (50' N of Toronto Refiners & 900' East of TRS) and at a control location. The data were similar to those from the corresponding AMB stations. On no occasion was the present standard of 15 $\mu g/m^3$/24 hours exceeded and the proposed standard was exceeded only in August (5.4 $\mu g/m^3$ at 50' N). The values were some 2-3 times those at the control location.

Particle sizing of suspended lead in air at 50' North of the plant indicated a very high portion of large particles ($< 7u$) and extremely skew distribution to the large particle end when compared to a control location.

Lead in Soil

Surface soil samples (0-2cm) were taken at some 26 locations. The readings showed very high standard deviations due to non-replication of samples from a few points at the same location. The data obtained to the north of the plant indicated lead levels of the same order as found by the Phytotoxicology section. There were some excessive values found immediately south of the plant (>100,000 ppm) which can only have been due to inclusion of large lead particles in the sample. Values of lead in soil in the backyards of houses in Niagara Street showed excessive levels (> 2000ppm).

Lead on Grass & Vegetation

Samples of grass were taken at 21 locations and analyzed not washed for lead excessive readings were found at the north and south property lines of Toronto Refiners (700 ppm). Moss bags were put

out and suspended for June 1973 before analysis. Readings in excess of 300 ppm were found at the property line (compared to 'normal' values of 80-100 ppm). The technique is interesting and should be investigated by the Branch.

Lead in vegetation sampling was only carried out in the backyards on Niagara Street. Seedlings were transplanted and used for 7 samples. The sample weight was low in each case but the values are of the same order as those found by AMB.

Contamination on Properties on South Niagara Street

Excessive lead contamination of soil and grass was found on properties on South Niagara Street. Food crops grown in the gardens were unfit for human consumption unless vigorously washed.

Comparison of lead in soil, house dust, paint, tap water at properties on South Niagara Street with a control area showed elevated levels in all except house paint. Even tap water showed levels 2-4 times the control area. The indication here is that lead absorption through ingestion & dietary intake may exceed normal levels particularly if personal hygiene is poor.

The overall findings regarding soil and food crop contamination are similar to those of the Phytotoxicology section except that reported levels in washed food crops are slightly higher in some cases.

Blood Lead Levels

The data reported for blood lead levels in the vicinity of Toronto Refiners are based on a small sample population from Niagara Street. The source of the data is not given but there are, in the report, implications that the U. of T. were involved in the sampling program. The limited data show an above normal distribution of blood lead levels compared to a control area.

Summary & Review of Branch Comments

The University of Toronto performed a study only in the summer 1973 so that statements regarding the success of clean-up measure are purely speculative and without data back-up.

In fact, there was a 20-fold reduction in vegetation lead levels in the back of houses on South Niagara Street from 1972 to 1973.

The study was more comprehensive than at Canada Metal & the findings are more meaningful. The data still however suffers from large standard deviations due to the limited sample size (and in some cases sample weight).

The use of moss bags and the sampling of paint, house dust and tap water are worthy of commendation.

It would appear premature to draw firm conclusions based on the quantity of data available in the Report. These conclusions, are however, more likely to be true than those at Canada Metal and to a large degree do not differ from the preliminary conclusions of the Air Management Branch.

The danger is to draw conclusions whilst ignoring obvious gaps and discrepancies in data.

Section 10. 1974 Programs at Canada Metal Company Limited & Toronto Refiners & Smelters Limited

For the Air Management Branch to be able to determine if the degree of control achieved at the Plants is adequate, to identify remaining sources of emissions, and to be in a position to evaluate clean-up measures for the area surrounding the plants an increased coordinated monitoring and surveillance program will be required in early 1974.

The questions to be answered -

1) What is the ambient air quality in the area?
2) What is the source of airborne lead?
   (a) Automotive
   (b) Re-entrainment of dusts
   (c) Plant emissions (and source of these)
3) What are the measurable plant emissions?
4) What are lead levels in soil and vegetation with any trends from previous years.
5) Are human body lead burdens acceptable?
6) What clean-up measures are required for the area?
7) Are extraordinary measures such as relocation of people or plant required?

The program aimed at collecting data to enable a definitive evaluation of the situation will have to use the combined resources of Air Quality Monitoring, Abatement & Approvals, Phytotoxicology surveys, Remote Sensing equipment, Stack Sampling and Medical results. A control location should be used for Phytotoxicology, Air Quality and Blood Sampling.

Air Quality Program

Canada Metal (on Toronto Refiners)

- Increased Hi Volume sampling and dustfall monitoring
- Location of simultaneous samplers upwind and downwind of plant in prevailing wind directions
- Use of dustfall and Hi-Volume samples for elements other than lead and analysis for Bromine to determine automotive contribution
- Use of aenemometers at hi-vol sites to get local wind conditions

Abatement & Approvals Program

- Obtaining plant operating logs for equipment including feed tonnages, etc. (to relate with hi-volume sampler data)
- Periodic inspection of control equipment and housekeeping procedures
- Prediction of impingement concentrations
- Prediction of particulate matter fall-out patterns

Phytotoxicology Program

- Winter snow sampling program of fresh and fallen snow to determine suspended particulate scavenging and on-going deposition under conditions not conducive to re-entrainment of previously deposited lead.
- Intensive soil and vegetation sampling program in spring 1974 with follow-up surveys in early summer.

Medical Program

- Additional sampling for blood lead determination in plant vicinity and control area.
- Characterization of lead content of household paint and dust,
- Correlation of blood lead with distance and with other factors for absorption of non-inhaled lead particles.

Remote Sensing

- Use of Mobile Monitoring Van at the plant property line to determine air levels of lead including size distribution.
- Mapping of ambient air lead levels in vicinity of plants.
- Possible use of Lidar Remote Sensing to determine variation of particulate density with height at various distances from the plant.

Special Studies

- Stack Sampling of lead sources before and after control equipment to determine emission factors and control equipment efficiency (not necessarily at Canada Metal or Toronto Refiners
- Coordination of the Program and preparation of progress and final reports.

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